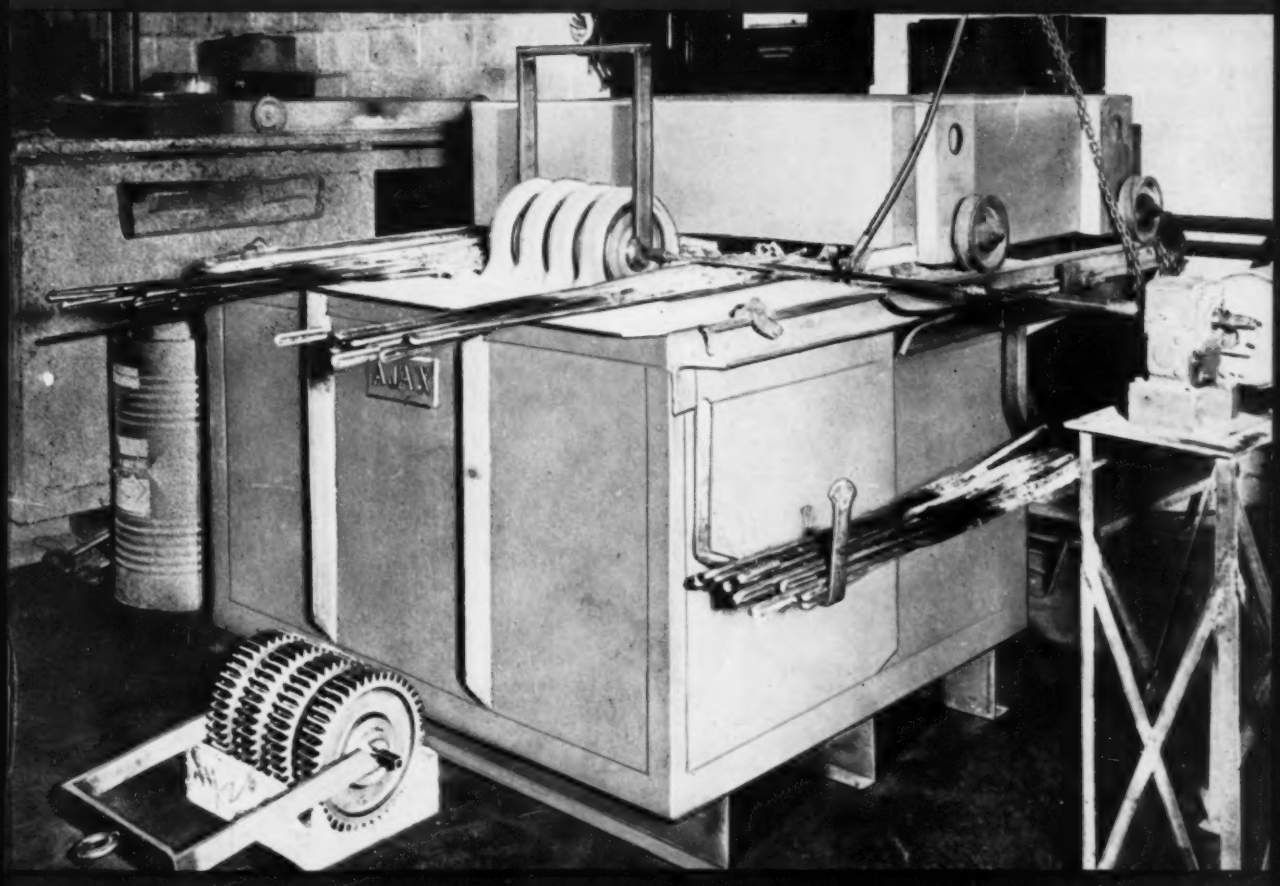
January-February 1958

METAL TREATING

METAL TREATING INSTITUTE

Gear teeth being hardened by the Tocco Induction Hardening Process in an Ajax Induction Furnace



THE *Only* MAGAZINE DEVOTED EXCLUSIVELY TO THE HEAT TREATING INDUSTRY

From the batch type installation at the left martempering base detonator fuses, to the huge mechanized furnaces austempering automobile bumpers illustrated below, Ajax Electric Salt Bath Furnaces are replacing old-style quench and temper methods for a wide variety of steel products.

In Modern Heat Treating— the Trend is to MARTEMPERING and AUSTEMPERING

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From bearing races to cast iron cylinder sleeves . . .

From uniformly shaped metal parts to odd and irregular sizes . . .

Scores of installations have proved the tremendous possibilities for economy, greater speed and efficiency in martempering and austempering, because all water and oil quenches are eliminated.

Distortion is so negligible that parts can be machine finished *before* hardening. Final grinding is eliminated or materially reduced. Scale, decarb and quench cracks are eliminated. Toughness and ductility are increased. The work is done materially faster—in less floor space—with lower labor costs. Let the Ajax Metallurgical Service Laboratory prove these claims on a specimen batch of your actual parts, under actual working conditions.

Write for Ajax Bulletin 120

AJAX ELECTRIC COMPANY, INC.

940 Frankford Avenue, Philadelphia 23, Penna

World's largest manufacturer of electric heat treating furnaces exclusively

AJAX HULTGREN **ELECTRIC SALT BATH FURNACES**

Editorial...

STANDARD CLASSIFICATIONS FOR TOOL STEELS

An important but relatively quiet and unpublicized activity has been developing recently which is of major importance to every heat treater and every heat treating department or commercial plant. This is the standard classification of tool steels being established by the Society of Automotive Engineers. The Society deserves the support and gratitude of everyone involved in the heat treating industry for this step for it will now become possible for all tool steel users to order their materials by an established designation which will signify not only analysis but the specific reactivity of the material as related to heat treatment.

One of the most frequent and regular of the many headaches confronting the heat treater has been the indefiniteness or failure of the customer or the engineering department or machine shop to furnish definite facts about the material being supplied for treatment.

Without such knowledge, of course, or with the vague designation so frequently offered, major errors can and have developed. In such instances, disastrous failures and heavy losses can occur. These, naturally, end up in violent arguments revolving around, "I thought it was this" and "You should have known it was that."

It is obvious that these headaches can be eliminated by the proper adoption of the Society of Automotive Engineers tool steel designations as applied to heat treatment. Plan to make use of these now and insist that the materials sent to you for heat treatment be clearly designated in accordance with these standards.

METAL TREATING

Official Journal of the Metal Treating Institute

National Trade Association of Commercial Heat Treaters

CONTENTS

Vol. IV JANUARY-FEBRUARY 1953 No. 1

FEATURES

NATURAL GAS & PROPANE-AIR GAS IN THE HEAT TREATING INDUSTRY 2
By Paul E. Peacock, Jr.

SUB-ZERO TREATMENT OF METALS FOR STABILIZATION 4
By R. S. Jamison

HEAT TREATMENT OF DUCTILE CAST IRON 6
By K. D. Millis

RECORDS SYSTEM FOR A HEAT TREATING PLANT 9
By C. H. Muehlemeyer

DEPARTMENTS

News to Heat Treaters 12
Institute News 14
The M.T.I. Membership 16
Heat Treating Abstracts 20
Heat Treating Hints 22
Manufacturers' Literature 28
Letters to the Editor 32
Index to Advertisers 32

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Natural Gas and Propane-Air Gas in the Heat Treating Industry

By PAUL E. PEACOCK, JR.*
LP Gas Plant Specialist
Westfield, New Jersey

In recent years there has been a tremendous expansion of natural gas pipe lines to serve new areas. Only recently many areas in the New England States have received natural gas for the first time. Other areas can and will receive this economical fuel in the months to come. This expansion of natural gas has contributed much to the heat treating industry's ability to meet the ever increasing higher quality demand placed on its products. Propane-air gas has played an important part also in this vital change. Natural gas and propane-air gas are noted for their high degree of purity and chemical uniformity that is so necessary to the generation of complicated controlled atmospheres.

It is no accident that gas is so satisfactory for the many applications in the heat treating field. The control that is possible in gas equipment is the result of years of research in developing tight furnaces and, later, in the development of prepared gas atmospheres. This development in the equipment field has played an important part in the expansion within the past few years of gas as a *must* fuel in many heat treating applications. With these later developments in improved equipment there has been an increasing demand by the metallurgists on the heat treating industry for special atmosphere generators for solving complex metallurgical problems. The use of these special atmospheres has been directed toward two important objectives:

a. To prevent or minimize changes in carbon content of the surface of the metal during heat treating and other processes which must be performed at relatively high temperatures.

b. To change the surface condition of the metal along controlled lines for improving the quality of the finished product.

Until about twenty years ago gas was thought of as little more than a convenient and flexible fuel for the heat treating industry. There had been but slight attempt at controlling the furnace atmosphere, in which application gas is the only satisfactory fuel. Heat treating of various products often requires high temperatures which contribute to the rapid decarburizing, scaling and oxidation of the metal surface.

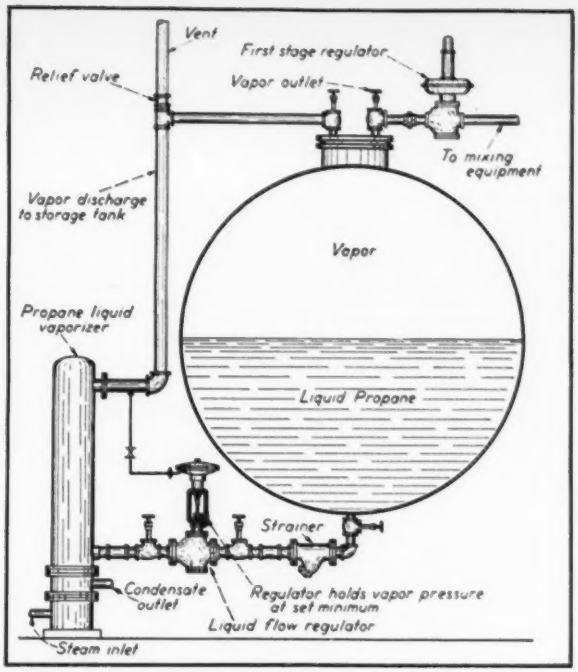
Charging one of the ATMOTROL muffle furnaces. MDX atmosphere generator is located right next to the furnace.

For medium or high carbon parts which must be subjected to considerable stress in their ultimate use, loss of carbon and surface imperfections due to scaling poses a serious problem.

Along with the increasing demand for better products, a gradual trend developed toward separating the work in the furnace from the products of combustion. The muffle type furnace represents one of the earlier attempts in this direction. This and other well-known types improved the quality of the work materially. It was found, however, that the removal of the products of combustion in itself was not enough. In addition to the removal of this objectional atmosphere,

Overall view of a heat treat room. Surface Combustion FORC-AIRE forced convection draw furnaces are in the foreground. A battery of eight ATMOTROL muffle furnaces with individual MDG prepared atmosphere generators are in the background. Propane gas is used to fire the furnaces and also for the atmosphere generators.

** Editor's Note—The author is a nationally recognized authority in the LP Gas engineering and operating field. Since 1930 he has designed more than 80 peak-load and standby plants for gas utilities and industrial firms, including several installations in foreign countries.*



Use of artificial vaporizer is recommended. Vapor is fed back to tank where it is held by single control to predetermined minimum pressure.

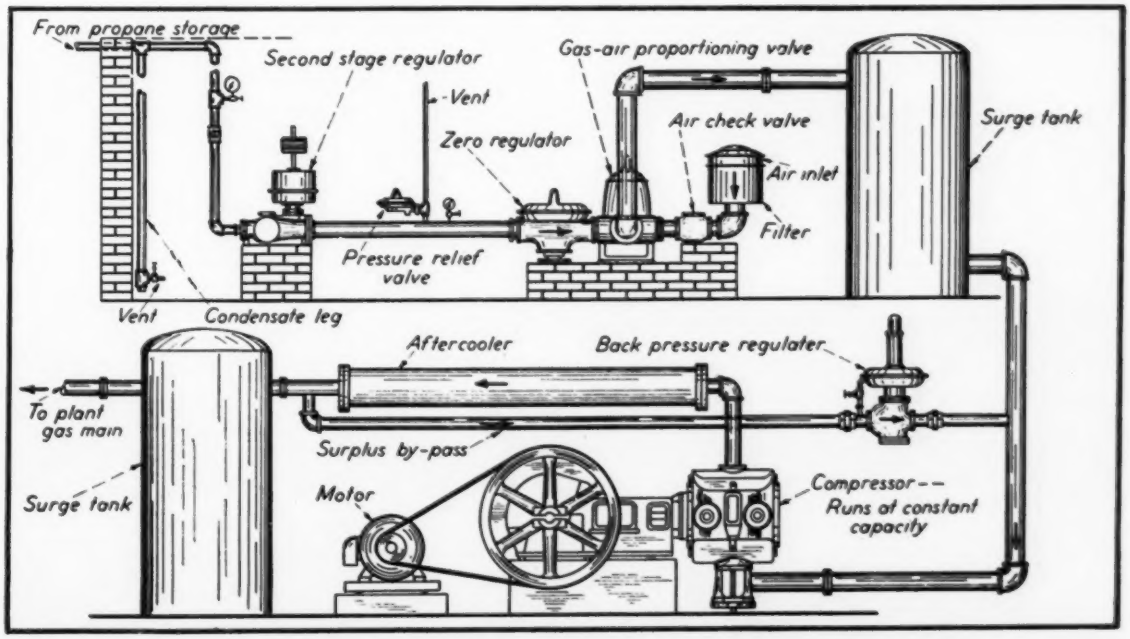
it was also necessary to provide a new, controlled atmosphere within the furnace for the particular job to be performed. It is in this newer heat treating application that natural gas and propane-air gas have played such an important role. One of the most important applications is gas carburizing.

The process of carburizing is applied to finished or semi-finished articles of ferrous alloys with the object of increasing the carbon content of the surface. The surface portion is then considerably harder than the underlying metal when suitably heat-treated. Thus a low carbon steel article that in its original condition will harden but little on quenching, can be carburized and then quenched to produce a hard, strong, wear-resistant surface and a soft, tough core.

Gas carburizing depends upon the ability of the carburizing medium to supply atomic carbon to the surface of the metal. This carbon is absorbed in the metal surface and is diffused into the outer layer. The rate of diffusion depends upon the temperature, the carbon concentration gradient and the factor of diffusivity for the particular metal in use. With proper equipment and the high quality of natural or propane-air gas, the metallurgist can perform many complex changes in the metal being heat treated.

Because of these developments and improvements in furnaces, and also with the special atmospheres, it is now an established practice in many fields to machine various parts completely by precise methods *prior* to heat treating. Thereafter the parts may be carburized, reheated, quenched and drawn and put into use without further operation other than possibly a light cleaning by shot blast.

(Continued on page 25)



Reciprocating compressor is used in mixing hookup for gas-main pressures exceeding 7 psig. Compressor runs at constant capacity with by-pass back to the cylinder and pressure regulator in the by-pass gas line.

Sub-Zero Treatment of Metals for Stabilization

By R. S. JAMISON
Sales Engineer
Sub-Zero Products Co.

Although Sub-Zero treatment of metals has a relatively short history, developments have been coming fast and furiously in the past 10 years. This is particularly true in the field of metal stabilization through cold-treating.

In passing, it might be well to mention that Sub-Zero treatment of metal offers advantages in other directions, namely the increase of hardness and ductility, transformation of Austenite to Martensite, gains in structure uniformity, increase of magnetic properties, increase in tool life and others. Naturally, some of these reactions have a bearing on the most important factor, size stabilization.

The complete transformation of Austenite possible with cyclic treatment, heat treat—cold treat—heat treat —cold treat, makes possible the production of parts and measuring apparatus that maintain sizes within microinches when necessary. (Fig. 1.) The process has been used with complete success on a wide variety of precision parts such as lathe bed and machine ways,

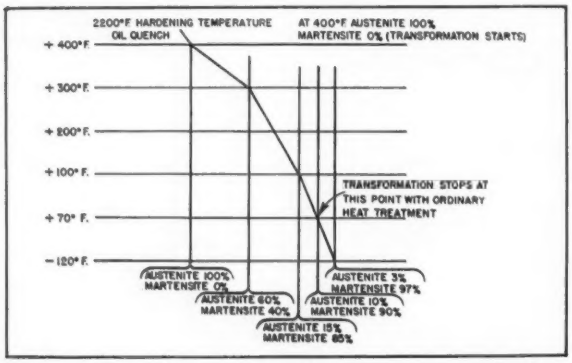


Fig. 1—The above chart was developed by a prominent metallurgist to show the curve of transformation of Austenite to Martensite in high speed steel at temperatures varying from plus 400° F. to minus 120° F.

gauges, arbors, mandrels, engine parts, aircraft bearings, etc. Since the process can be completed in hours or several days at the longest, the time and money formerly spent in conventional "aging" is practically eliminated. The growth associated with parts tempered by conventional means no longer occurs.

The Sub-Zero process of size stabilization involves three main factors. First, the part is uniformly hardened by proper heating and quenching. Second, Austenite is completely transformed to Martensite by Sub-Zeroing alternated with heat treating. (Fig. 2.) Third, the Martensite is thoroughly tempered in a draw. In most cases, one chill and one temper are sufficient.

Fig. 2—A 10 cubic foot chilling chamber Sub-Zero cold treatment machine used alternately to achieve proper structural stabilization.

Final finishing of the part should be done after this process. The part, now having a complete Martensitic structure, is larger because the Martensite grain structure is larger than that of the Austenite. Research indicates that parts stabilized by this method will increase in hardness by about one point, Rockwell C scale.

Various metals stabilized by the Sub-Zero process include the following:

High-carbon, High-chrome steel. These steels have a transformation point higher than that of high speed steels. A low temperature of minus 100° F. will transform the Austenite carried over from the quench. The use of minus 120° F. temperature affords a desirable safety factor.

Nickel-carburizing steels. When steels of SAE 3312, 3115 and 2000 series are carburized, hardened and tempered and found to be below hardness specs, the Rockwell hardness will be improved and complete stabilization effected by cooling to temperatures of minus 120° F.

Tungsten shock steels. If these steels are Rockwelled immediately after the quench and found lacking in hardness, the Sub-Zero treatment can be applied before any tempering operation. This adds hardness and stabilizes the part at the same time.

SAE 52100. Rather sluggish in transformation, this steel is ideally suited to easy stabilization by Sub-Zeroing.

Since it is widely used in applications requiring close ground or lapped tolerances, size stabilization is generally important. Sub-Zeroing eliminates size

Fig. 3—Form cutter of 18-4-1 tool steel used in gear tooth cutting. Gear material SAE 420 Brinell 387. After Sub-Zero treatment at —120°F. performance life 510 pieces in 6 hours as compared to 150 pieces in 6 hours.

changes due to standing at room temperature or by variable atmospheric temperatures such as in high flying aircraft. Additional toughness and hardness are also secured with the complete transformation.

Other ferrous metals. Other steels, cast iron, stainless, are among varied metals which have been stabilized by Sub-Zeroing. As a matter of fact, any metal subjected to unusual loads, extreme temperature changes or requiring perfect dimensional stability is a logical candidate for the Sub-Zero treatment. (Fig. 3.)

Non-ferrous metals. Aluminum, among other non-ferrous metals, has been Sub-Zero treated. In all cases, no physical change in grain structure is evident. However, all internal stresses and strains are relieved; parts are normalized and fully stabilized.

In actual production, two applications will serve as examples of processes, requirements and results:

1) Commercial steel treating firm stabilizes machine tool wear strips: Type 91140 graphitic steel in lengths up to 16 feet long are first flame hardened to a minimum RC 60 to a minimum depth of $\frac{1}{8}$". Part is then placed in an 18 foot long Sub-Zero Chilling Machine (Fig. 4), immersed in a methylene chloride solution held at minus 120° F. After 24 hours at this temperature the parts are removed and allowed to come to room temperature. Austenite is reduced to approximately 3% and practically complete stabilization is achieved. The parts are then drawn at 350-400° F. until the Martensite is thoroughly tempered. While hot, they are straightened, made ready for finish machining and grinding.

2) Ball and roller bearing manufacturer stabilizes bearing races up to 48" in diameter: SAE 52100 steel, SAE 4620-4720-8620 carborized steels and type 440C stainless steels are processed to obtain all possible toughness and ductility along with dimensional stability. The bearings are chilled at minus 120° F. in a convection fluid, within a Sub-Zero Chilling Machine. While complete data is not available, the user reports an increase in hardness together with complete dimensional stability. This operation was formerly done with dry ice and alcohol; the Sub-Zero unit has eliminated need for dry ice and assures lower, easily controlled temperatures.

Fig. 4—An 18 ft. long Sub-Zero chilling unit used to age parts after flame hardening. The 16 ft. bar being lowered into the unit will remain in a methylene chloride solution for 24 hours.

Heat Treatment of Ductile Cast Iron

By K. D. Millis
Development and Research Division
International Nickel Co., N. Y. City

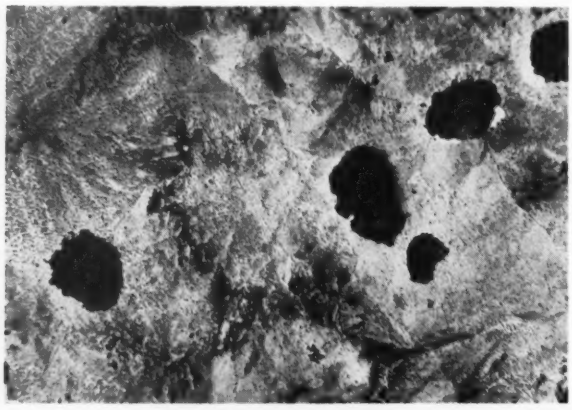
Ductile Cast Iron is a magnesium-containing high carbon iron with the graphite occurring in a spheroidal form. In the as-cast condition, Ductile Iron can be made to a fairly wide range of mechanical properties with tensile strengths varying from about 70,000 psi to 110,000 psi and with up to 20% elongation. The level of properties to be attained as-cast is dependent upon composition, section size and cooling rate in the mold.

In the event conditions are such that the desired properties are not accomplished as-cast, or if the desired properties are outside of the as-cast range, one of several heat treatments of relatively short duration may be employed to produce the desired end result. The use of heat treatments broadens the property ranges so that Ductile Irons with tensile strengths from 60,000 psi to over 200,000 psi and with up to 25% elongation are available.

There are two types of heat treatment used for Ductile Iron: annealing which softens the iron, and normalizing or quenching, plus a draw, which hardens the iron.

Annealing Treatments

If the application requires more ductility than is achieved in the as-cast condition, or if high machinability is the chief requisite, an annealing treatment

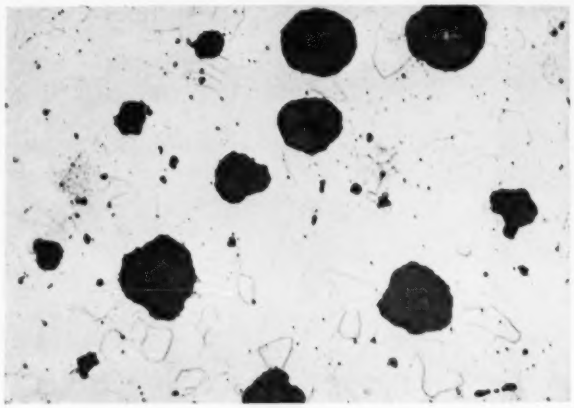


As Cast — pearlitic.

may be used. There are several annealing treatments which are commonly used and they are as follows:

(1) Heat to 1600-1650°F., cool to and hold at 1275-1290°F., furnace cool to 1100°F., then air cool.

(2) Heat to 1600-1650°F., furnace cool to 1200°F., controlling the rate between 1450° F. and 1200° F. at a maximum of 35°F. per hour.



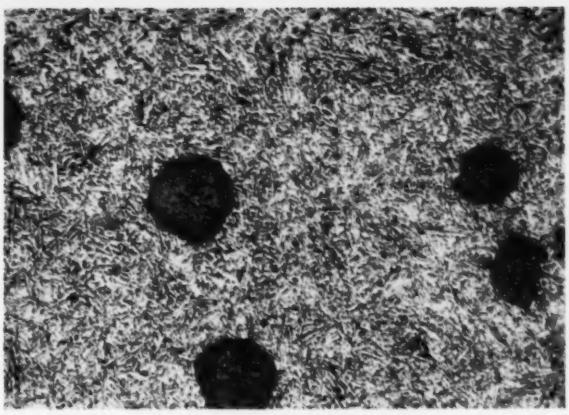
Annealed — ferritic.

(3) Heat to 1300°F., furnace cool to 1100°F., then air or furnace cool.

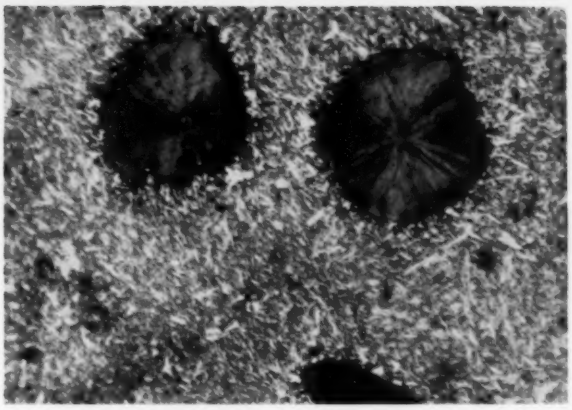
(4) Heat to the range of 1000-1250°F. This is primarily a stress relief and causes only partial softening.

To produce the softest matrix and best ductility, the first listed anneal must be employed. This is accomplished by cooling directly from the 1600-1650°F. temperature to one just below the critical temperature to permit the transformation of pearlite into ferrite. This necessarily requires an accurate control of the lower temperature for as it decreases, the rate of ferritization decreases rapidly and if it gets too high, the critical temperature will be exceeded resulting in some residual pearlite in the casting. The temperature for second stage annealing is 1275°F. and it should not go above 1290°F. or below 1265°F. The time required to achieve a complete anneal is about 5 hours for Ductile Iron of normal composition. This time may need to be increased for heavy section castings, i.e., 4 to 6 inches, or for castings containing small amounts of pearlite stabilizers such as copper and chromium.

The *second listed* annealing treatment is used in cases where it is not convenient to hold at the lower temperature. In this case the castings may be furnace cooled at any convenient rate from 1600-1650°F. to 1450°F. Further cooling then proceeds at a controlled rate of no faster than 35°F. per hour down to 1200°F. In this type of anneal, ferrite forms directly from austenite. The transformation is normally completed by the time the 1200°F. temperature is reached. This method is often found simpler to use when large



Isothermally transformed at 800°F. — Intermediate Product.



Quenched and drawn at 1050°F. — Intermediate Product.

batches of castings are being annealed and the natural rate of cooling in the furnace is less than 35°F. per hour.

The *third listed* annealing treatment may be used when the castings are known to be completely free of primary carbide as-cast. By heating to 1300°F. and holding, the pearlite which has formed during cooling of the casting is transformed into ferrite. The time required for complete transformation will be about the same as is necessary at 1275°F. in the two stage anneal.

The *fourth listed* treatment is essentially for relief of casting stresses when they are prone to occur due to rapid cooling or complicity of sections, and may result in partial softening. (Ductile Iron is an elastic material like steel with a high yield strength and is capable, therefore, of developing internal stresses.)

The cooling rate from low temperature annealing treatments will have no bearing on the matrix structure. However, it may have a bearing on the retention of residual stresses in the casting and should be carried out, therefore, at a rate sufficiently slow to prevent setting up such stresses. The complexity of the castings is an important consideration in the determination of cooling rates. It is generally good practice, however, to cool in the furnace to about 700°F.

The first three treatments produce ferritic structures and when properly carried to completion, the iron should have a hardness of less than 180 Brinell and preferably should be below 170 Brinell. The normal Ductile Iron compositions after proper annealing should have properties approximately as follows:

Yield Strength—psi	50,000-55,000
Tensile Strength—psi	65,000-70,000
Elongation	15%-25%

It should be pointed out, however, that the tensile properties are dependent upon the relative amounts of pearlite and ferrite in the microstructure and that other combinations of properties can be developed by halting the anneal at various times before completion.

Normalize and Quench Treatments

When a higher strength level or higher hardness than attained as-cast is required, Ductile Iron is submitted to the same types of heat treatment that are used for steels. The common treatments are:

(1) Normalize from 1600-1650°F. followed in most cases by a draw at some temperature up to 1200°F.

(2) Oil or water quench from 1550-1650°F. followed by a draw at some temperature up to 1200°F.

The effectiveness of the normalizing treatment is largely dependent upon the section size which influences the cooling rate, the presence of sufficient carbon dissolved in the iron for hardening response, and the alloy content of the iron. Ductile Iron differs from steel in that it contains a large quantity of free graphite which may be dissolved in the iron at austenitizing temperatures and the amount dissolved increases as the temperature is elevated. Austenitizing temperatures of from 1550°F. to 1650°F. are used and should not be exceeded since excess carbon would be dissolved. The soaking time at the austenitizing temperature depends on the initial matrix structure. For example, castings which are initially ferritic and thus contain very little carbon in solution must undergo a longer soaking period at the austenitizing temperature than castings which are pearlitic. In general, castings below 220 BHN should be held at temperature for periods up to an hour while less time is required for castings above 220 BHN. If the

TABLE I

Tensile Properties of ½ Inch Ductile Iron Sections Normalized From 1600°F. (1 hour)

Draw Temperature °F	Tensile Strength psi	Yield Strength psi	Elongation %	Hardness BHN
None	142,000	96,000	7.5	265
1100	136,000	96,000	7.5	273
1200	134,500	91,000	8.0	257

TABLE II

Tensile Properties of Quenched & Drawn Ductile Iron*

Quench Temp. °F	Draw Temperature °F	Tensile Strength psi	Yield Strength psi	Elongation %	Hardness BHN
1600	700-1 hr.	156,000	156,000	2.0	350
"	900-1 hr.	152,000	136,000	7.0	284
"	1000-1 hr.	150,000	133,500	4.0	297
"	1100-1 hr.	134,000	120,000	7.0	264
"	1200-1 hr.	99,500	83,500	9.5	204
1550	800-1.5 hr.	185,000	150,000	1.0	430
"	800-1.5 hr.	218,000	167,000	1.0	418
"	900-1.5 hr.	196,000	121,000	2.5	402
"	900-1.5 hr.	153,000	131,000	1.5	302
"	1000-1.5 hr.	161,000	147,500	1.5	351
1575	1000-3 hr.	142,750	119,800	4.0	290
"	1050-3 hr.	113,600	95,250	5.5	241
"	1150-3 hr.	85,250	67,250	14.5	186

*Private Communication, F. B. Rote and G. A. Conger, University of Michigan.

"Ductile Iron Replaces Alloy Gear Castings, Forgings," by J. D. Sheley, Iron Age, May 10, 1951.

"Quench-Temper Treatment Improves Nodular Irons," by J. E. Rehder, Iron Age, Jan. 17, 1952.

structure initially is fully pearlitic, very little time is required at the high temperature.

Castings up to 1 inch in section thickness respond satisfactorily to normalizing treatments. Table I lists some properties which were developed in ½ inch sections normalized from 1600°F. and drawn at several temperatures. Castings heavier than 1 inch are progressively less responsive to air cooling, although the response may be improved by alloying.

The response of Ductile Iron to quenching is likewise dependent on section size, the amount of carbon in solution, and the alloy content. Higher strengths and hardnesses result from quench and draw treatments than are obtained by normalizing. In Table II are listed properties that resulted from actual quench and draw treatments. Various compositions, section sizes and quenching media are represented in these results which accounts for the fact that in some cases, the same draw temperature has yielded different strength and hardness levels. It will not be possible to designate definite draw temperatures to yield specified properties until sufficient data has been generated for each set of conditions. At present, it is necessary to draw to the desired hardness level after first determining the proper draw time at a temperature for the particular set of conditions in the casting.

There are wear applications whose hardness requirements demand a more severe quench than is accomplished in oil. The quench medium used under these circumstances is usually water and hardnesses from 52 R_c to 58 R_c are common. Care must be exercised in choosing the quenching medium in order to prevent cracking due to excessive internal stresses. The complexity and hardenability of the casting should be considered. When quenching is used for hardening, a low temperature draw should follow simply for stress relief with a minimum of softening.

In addition to its response to normalizing and quenching, Ductile Iron is like steel in that it responds also to isothermal quenching, flame hardening and induction hardening. Unless specially alloyed, its hardenability is about the same as medium carbon, low alloy steel.

7 Reasons Why You Should Join

The Commercial Heat Treaters

OWN

Organization

1. It maintains up-to-the-minute contact with all government departments in Washington whose activities do or can affect the commercial heat treating industry in any way, permitting immediate transmission of important information to all members.
2. It protects and advances interests of membership.
3. It collects and assimilates pertinent data relating to the industry.
4. It works to protect the industry against unfair and unjust burdens or lack of appreciation of its importance and significance.
5. It fosters and supports fair business practices.
6. It promotes better relations between members, employers and employees.
7. It promotes the use of commercial heat treating services.

METAL TREATING INSTITUTE

Association of Master Craftsmen

271 NORTH AVENUE NEW ROCHELLE, N. Y.

Records System for A Heat Treating Plant

By C. H. MUEHLEMEYER, *General Manager*
O. T. Muehlemeyer Heat Treating Co.
Rockford, Illinois

This system was designed to provide production department operators with customer specifications and routing information for the operations required, to provide the invoicing department with a complete record of the operations performed for accurate pricing and at the same time furnish the shipping department with proper shipping forms to make either complete or partial shipments without delays normally required to prepare shipping forms.

A "spirit" duplicating machine, one in the shipping office and one in the invoicing office, is used. A single "master" form, Figure 1, is typed from information furnished by the customer's packing list, purchase order, or blue print. From this master four forms are printed or "duplicated" in the shipping room office:

1) Shop job tickets on heavy buff paper (copy for each item).
2) Job tickets on light white paper (shipping office copy).
3) Our packing list with shipping instructions (office copy).
4) Our packing list with shipping instructions (customer's copy).

Distribution of these forms is shown in the flow diagram, Figure 2. The original master form is now transferred to the invoicing office where it is filed until completion of the work. After the completed job tickets arrive in the invoicing office, prices are entered and extended in the appropriate columns on the master form, extra charges for straightening, grit blasting, masking, etc. are typed in and the invoice forms are duplicated from it.

When a purchase order contains more than one item a job ticket is printed for each item. At this point the job tickets for a single purchase order are identical. However, instruction details for hardness, selective hardening, etc., are marked in with pencil in the blocks at the top of the job ticket form and refer to only the single item identified by the arrow in the right hand column. Operators mark the job ticket with the temperatures used, inspection hardness, straightening time, masking time, etc. Each operator moves the job on to the next man as his own operation is completed. The job tickets are kept clean and legible by handling them in heavy

INVOICE DATE

SOLD TO
Example Tool Mfg. Co.
Example Street
Rockford, Illinois

SHIP TO
Same

SHIP VIA

TERMS: 1% 10 DAYS, 30 DAYS NET OUR ORDER NO. 00001 YOUR ORDER NO. 10000

QUANTITY ORDERED	DESCRIPTION MATERIAL WEIGHT		PRICE	AMOUNT
6	No. 1234 Ways C&H per print	C1018 300 lbs.		

Fig. 1—Master form is prepared with typewriter this far in shipping office. After duplicating job tickets, and shipping tickets the master is filed in the invoicing department until parts are completed and shipped.

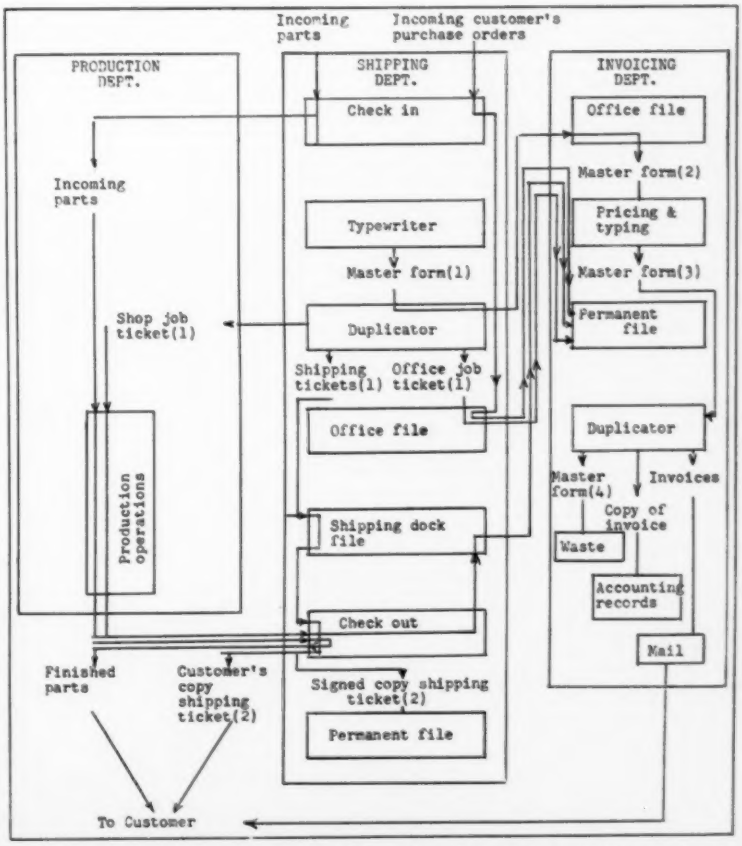


Fig. 2—Flow diagram showing movement of forms through production and offices. Bracketed numbers show sequence from origin to completion.

cellophane jackets in the production departments. Tickets stay with the job except when items are actually in the furnace or quench. (Figure 3.)

For customers who require partial shipment of an order (or in some cases a single item) extra copies of our packing list are duplicated ahead of time and kept on file. With these the exact quantity shipped may be shown in pencil on the accompanying packing list and a running tally kept on our own copy of the packing list. This feature avoids considerable confusion in shipping during rush periods.

Advantages and Disadvantages

The system has achieved its intended purpose without requiring additional office help. Additional cost exists for the greater volume of paper involved with respect to our old system. However, this cost is recovered several fold by the legitimate "extra" charges which were formerly frequently overlooked because they were not communicated to the invoicing department.

Invoice typing is greatly speeded up because on most orders only prices and extensions are typed into the masters. There is no repeat typing of the customer's name, part description, weight, etc. This frees the typist for assisting in the shipping room for the day-end rush when late incoming orders are prepared for second and third shift operations. (Figure 4.)

Overall production has been increased by providing on-the-job information which permits the operators to work more efficiently. Because all operations are shown on the job ticket work spends less time waiting to move to the next operation or department and requires no attention from a stock chaser.

When orders arrive after the shipping office closes at 5:00 P.M., those orders which are "rush" start through production on a job ticket filled out in pencil. This causes some confusion and duplication of effort next day when "duplicated" job tickets catch up. However, this disadvantage has not been seriously objectionable.

There is some objection to the greater volume of file space required, since all job tickets thus far have been permanently filed. However, the balancing advantage is the excellent refrence information it provides for repeat jobs.

The system has been functioning for nearly two years and all departments find it satisfactory.

Fig. 3—Job ticket (upper left) and shipping ticket. Work information is penciled in top block of job ticket (upper left). These forms are "duplicated" in the shipping office from the master form shown in Figure 1. Shipping office copy of job ticket (lower right).

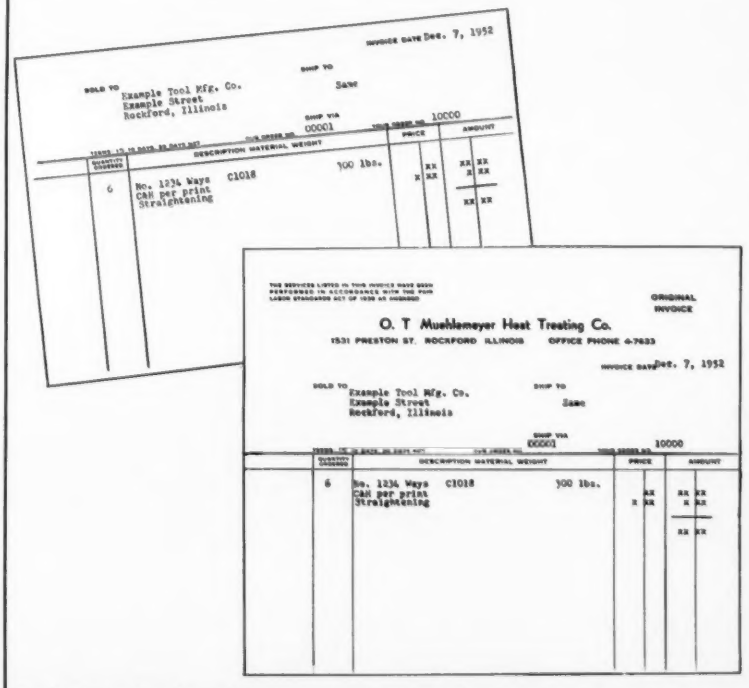
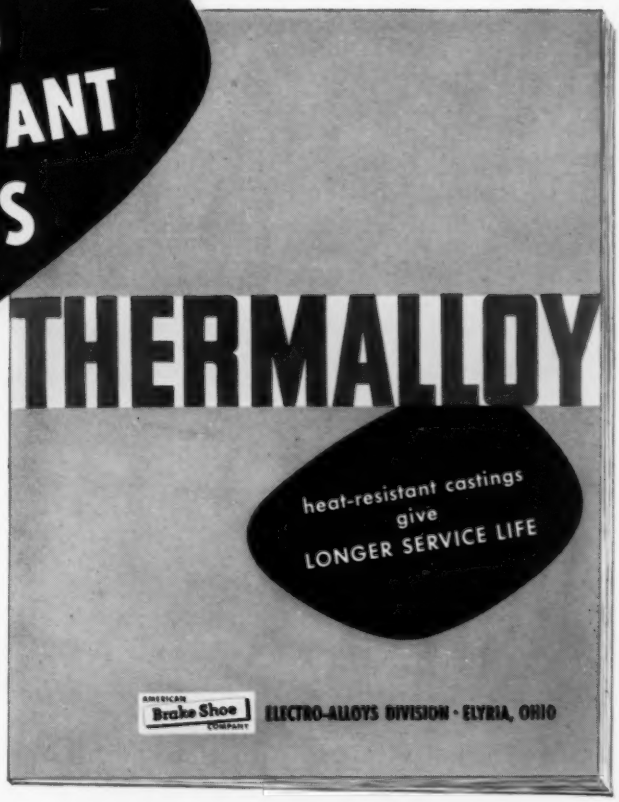


Fig. 4—Master form (upper left) after typing in prices and extensions and extras for wheelabrating and straightening in the invoicing office. Invoices are then "duplicated" in as many copies as customer requires. Office copy of invoice is shown (lower right).

here's help
in ordering
HEAT-RESISTANT
CASTINGS



NEW BOOKLET
gives complete information about THERMALLOY*

Ordering the *right* heat-resistant castings that give you top performance with the longest service life . . . requires a careful analysis of your problem. At Electro-Alloys, you will find the trained personnel and facilities needed for this service.

This new, 16-page, illustrated booklet will give you the complete story . . . with photographs of modern foundry facilities . . . case histories of Electro-Alloys design and engineering help . . . suggested Thermalloy applications for your industry . . . technical charts that give you detailed performance figures for the various grades of Thermalloy.

For your answers to how Electro-Alloys can help you with Thermalloy heat-resistant castings, write for your free copy today . . . Electro-Alloys Division, 4003 Taylor Street, Elyria, Ohio.

*Reg. U. S. Pat. Off.

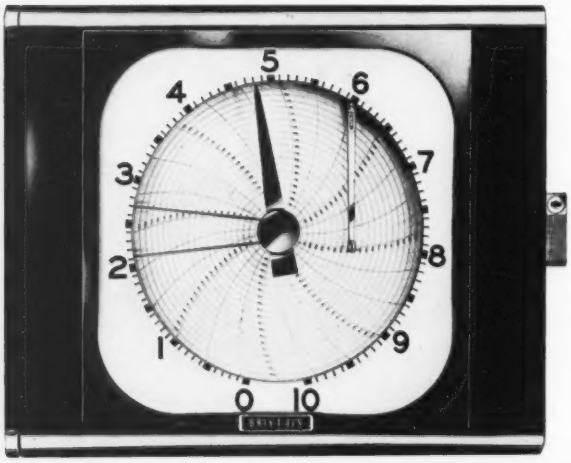
AMERICAN Brake Shoe COMPANY

ELECTRO-ALLOYS DIVISION
ELYRIA, OHIO

News to Heat Treaters...

Round-Chart Recorder

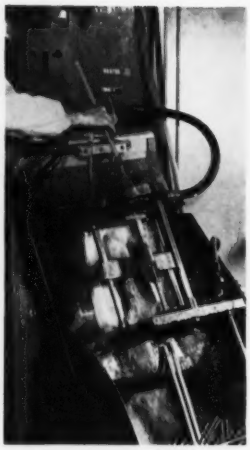
The Bristol Company, Waterbury 20, Conn., announces the addition of round-chart recorders and automatic controllers to its line of electronic Dynamaster potentiometers and bridge instruments. The new round-chart Dynamaster models are accurate, high-speed, continuous-balance, null-type electronic instruments which can be used to measure any variable that can be translated into an electrical quantity such as d-c current, d-c voltage, capacitance, or resistance. Typical sensing elements that can be used with the new Dynamaster instruments include thermocouples, radiation detecting units, resistance thermometer bulbs, pH amplifiers, tachometer magnetos, strain gauges, smoke density detectors, thermal converters for power measurements, beta ray gauges, and many others.



The measured variable is simultaneously recorded on a 12-inch diameter chart and indicated on a large circular scale which is legible at a distance. Models are offered for full-scale pen travel in 7 seconds, 3 seconds, 1½ seconds, or 2/3 second, and with a wide variety of ranges. Controlling models with all types of air control and electric control action is also available.

The new round-chart instruments feature the same design, construction and electronic components as the company's strip-chart Dynamaster instruments. The unit universal construction permits complete interchangeability of components. The recording mechanism is on the front of a hinged aluminum alloy panel, which can be swung out to gain easy access to the electronic components. The instruments are housed in a moisture-, fume-, and dust-proof case suitable for wall, flush-panel, or front-of-panel mounting. Round-Chart Electronic Dynamaster instruments are described in Bristol Company Bulletin P1245.

Easy Washing Machine



Operator at the Easy Washing Machine Company, Syracuse, N. Y., uses a General Electric 15-kw electronic induction heater to harden basket shafts for use in the firm's product. The induction coil, not visible in this picture, is inside of the quench ring into which the operator is shown inserting a shaft. Easy officials say that use of the heaters has reduced hardening costs 48 per cent from previously used chemical hardening methods.

Metals Comparator Improves Quality Control

Better quality control and reduced testing costs have resulted from the use of an electronic metals comparator at a large Cleveland, Ohio, automotive manufacturing plant.

The metals comparator, a General Electric product designed to detect and indicate variations in hardness of metals by measuring differences in magnetic characteristics, is used to test universal trunnion yoke bearings.

The bearings, used in truck universals, are small cylindrical steel objects in which needle bearings are enclosed. In order to withstand wear, the inside surfaces must be carburized and specially heat-treated.

After the heat-treating, the automobile company runs a 100-per cent inspection on the bearings to assure their being up to uniform standard.

(Continued on page 18)

Houghto-Quench

the fastest quench this side of water!

. . . provides the safe, sure quenching needed for "LEAN ALLOY" steels!

Use Houghto-Quench to meet your most critical quenching needs. We developed this stable oil to give you all three of these essentials that heat treating low alloy steels demand:

1. A faster quench through the critical zone
2. Full hardness to meet high physicals safely
3. Uniform quenching of *any* steel at *any* temperature

Ask the Houghton Man to show you why it pays you to specify Houghto-Quench—particularly today. Or write to E. F. Houghton & Co., Philadelphia 33, Pa., for full information.

DO YOU HAVE OUR HANDBOOK ON QUENCHING?

Contains complete information on this important phase of heat treating. We'll gladly mail a copy, without charge, to anyone engaged in metal processing.

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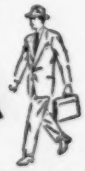


Ready to give you on-the-job service . . .

Institute News . . .

CHICAGO REGIONAL MEETING

A meeting of the Chicago Chapter was held at Elliot's Pine Log Restaurant in suburban Chicago on November 14, 1952. Chicago Chapter President, Clarence Graham, presided and the following companies were represented:

Accurate Steel Treating Co.
Chicago, Illinois

American Steel Treating Co.
Crystal Lake, Illinois

Harris Metals Treating Co.
Racine, Wisconsin

Hushek Metal Processing Co.
Milwaukee, Wisconsin

Chicago Steel Treating Co.
Chicago, Illinois

Lindberg Steel Treating Co.
Chicago, Illinois

O. T. Muehlemeyer Heat Treating Co.
Rockford, Illinois

Pearson Industrial Steel Treating Co.
Chicago, Illinois

Perfection Tool & Metal Heat Treating Co.
Chicago, Illinois

Racine Heat Treating Co.
Racine, Wisconsin

Senecca Heat Treating Co.
Batavia, Illinois

Fred A. Snow Company
Chicago, Illinois

Metal Treating, Inc.
Milwaukee, Wisconsin

Wesley Heat Treating Co.
Milwaukee, Wisconsin

Wesley Steel Treating Co.
Milwaukee, Wisconsin

Wesley Metal Treating Co.
Racine, Wisconsin

Spindler Metal Treating Co.
Racine, Wisconsin

Guests present were as follows:

Mr. A. M. Cox—Pittsburgh Commercial Heat Treating Co., President of the MTI

Mr. C. M. Cook—Cook Heat Treating Co. of Texas, Vice President of the MTI

Mr. C. E. Herington—Executive Secretary of the MTI

Mr. C. U. Scott—C. U. Scott and Sons, Founder of the MTI

The meeting was devoted to some discussion concerning the problem of attendance at the Annual Meetings in view of the fact that there had been some concern evidenced by several of the members over the fact that the Chicago Chapter had not been well represented in Philadelphia in October. It was pointed out that attendance varies in accordance with the location of the Annual Meeting and it was definitely emphasized that this was the major factor involved and that many persons had planned to attend but due to the pressure of business at that time of the year and the time which would have had to be consumed made it prohibitive.

Chapter President Graham called upon Charlie Scott as an old time member and as one of the original founders of the MTI to say a few words and he reviewed briefly some of the past problems of the Institute and stimulated a discussion around the subject of the recent rapid growth, success and financial stability of the organization and its official publication METAL TREATING.

Vice President Cook discussed the progress being made in arranging for the forthcoming Spring Meeting which is to be held in Houston, Texas, at the Hotel Shamrock, May 17, 18 and 19. Mr. Cook is making plans for some unusual entertainment and also an interesting sight-seeing tour of the neighborhood.

Executive Secretary Herington presented a brief financial report and also discussed in some detail a plan for a national cooperative advertising campaign to be conducted in trade magazines and indicated that a number of members had already agreed to the importance and value of such an activity.

Some discussion followed concerning the various releases sent out to the membership as part of the service, such releases covering various subjects regarding government regulations, renegotiation and other items which might affect the members' business and it was generally agreed that over a year's time these releases provided useful and important information.

EASTERN REGIONAL MEETING

An Eastern Regional Meeting was called by President Al Cox and was held at the Hotel Governor Clinton in New York on Friday, January 16th. Those present gathered for luncheon at 12:30 after which the meeting was called with President Cox presiding at 2:30 P. M.

The first guest speaker was Mr. J. Y. Riedel, Tool Steel Engineer of the Bethlehem Steel Company, Bethlehem, Pa., who showed the group a series of excellent slides of various dies, tools and other parts which had failed under heat treatment because of poor design, incorrect material and other factors not the responsibility of the heat treater. It was pointed out that the heat treater can do a great deal to prevent such failures which are all too frequently unjustly blamed upon him by being prepared and willing to advise his customer as to design, materials, properties achievable and so forth.

Mr. Riedel also reviewed a new book which has just been published by Bethlehem Steel entitled "The Tool Steel Trouble-Shooter," a copy of which he distributed to all attending. This was received enthusiastically as being of real value to a heat treater.

A lively discussion period followed with interesting points being developed and answered.

Mr. Riedel was accompanied by Mr. J. P. Mayshark of Bethlehem's New York office who was instrumental in securing Mr. Riedel for the program.

The following companies were represented:

Pittsburgh Commercial Heat Treating Company
Pittsburgh, Pennsylvania

Benedict-Miller, Inc.
Lyndhurst, New Jersey

Porter Forge & Furnace, Inc.
Somerville, Massachusetts

Commercial Metal Treating, Inc.
Bridgeport, Connecticut

Fred Heinzelman & Sons
New York, New York

Metlab Company
Philadelphia, Pennsylvania

Alfred Heller Heat Treating Company
New York, New York

The second speaker for the afternoon was Mr. Rex Bulley of the E. T. Smith Company of Philadelphia, who handles the special heat treating insurance policies available to MTI members. Mr. Bulley revealed the fact that a Mr. Field from Lloyds of London is planning to visit the United States in the spring with the idea of studying the experience that has been had with member insurance. It is planned to attempt to secure information from the members which will enable further studies aimed toward a reduction of the premium for the establishment of a procedure whereby policy holders presenting no claims over a 12-month period will be rewarded.

Mr. Bulley indicated that there was an increasing interest in this insurance plan and that it was hoped that during 1953 a number of other MTI members would participate.

FURNACES AVAILABLE BY LEASE

Word has been received from Mr. L. A. Shea, Chief, Industrial Heating Equipment Section, Metalworking Equipment Division, Department of Commerce, that heat treating furnaces are available by lease only through the N.P.A. at the rate of 1% per month of approximately World War II acquisition prices. Clearance must be arranged by contacting the Inventory Branch of the Metalworking Equipment Division of N.P.A. in Washington, D. C. (Phone STerling 3-5200, Extension 7797).

Mr. Shea's letter goes on to say, "This equipment when installed by commercial heat treaters is considered Defense Support and it is not necessary to establish identification of particular contracts which the installation will serve. At this time no provisions are made for purchase of this government owned equipment, necessitating return of it in the event of no further need. However, this could very well be changed by the end of Defense Production requirements."

Here is an opportunity for commercial heat treaters to secure for production additional facilities and such opportunities should be developed as needed with the idea of preventing the needless installation of departmental functions for temporary work.

MTI APPRENTICESHIP PROGRAM AND MANPOWER

A recent release from the Research Institute of America, Inc., New York, New York, which is quoted below serves to spotlight the far-sightedness of the membership of the MTI in setting up apprenticeship training activities in their plants. Members involved in or developing such programs should keep in mind the presentation made at the last Annual Meeting whereby the International Correspondence Schools, Scranton, Pennsylvania, have established complete basic training courses in line with the apprenticeship standards which have been developed by the MTI and approved by the Department of Labor.

The Release follows:

"*Skilled Worker Shortage*

Latest manpower Policy Statement (No. 5) from the Office of Defense Mobilization says the answer to the problem is training—and training is industry's job. All the government will do is encourage employer programs, help secure cooperation of labor and community facilities, and assist in developing on-the-job and apprentice training—no financial assistance to employers, no revival of World War II training-within-industry.

"*Recommendation*

Employers who have been holding back on training should contact their local state employment office whose training experts will be available for technical assistance in evaluating and improving the employer's training programs. No charge and no obligation; the employer is always free to disregard the suggestions. In some areas, vocational schools will tailor their training to the needs of employers in return for payment of part of the cost."

"We girls visited a heat-treating plant today, -they showed us how they hardened things."

Sound advice...

"LOOK-

before you LEAP!"

Only the Co

And

If you are considering plans for expansion of present heat treating facilities or new plant construction, "Look Before You Leap" —check with an MTI commercial heat treater.

The chances are that you will find a Commercial Heat Treater near your plant with the facilities, equipment, skill and experience to perform "custom-tailored" heat treating operations required for your prime or sub-contract rearmament program work.

Eliminate Personnel Problems

All members of the Metal Treating Institute are specialists with complete service facilities under one roof. They offer you a variety of skills — handling and processing all types of heat treating from simple stress relief to delicate controlled atmosphere hardening, cyaniding, etc. This experience and know-how would be practically impossible for you to duplicate under today's conditions.

Avoid Future Waste

The recent post-war years proved the wisdom of using established facilities in your locality. Many expanded plant departments and new construction had to stand idle or be scrapped when the crisis passed. It is good business to avoid possible repetition. Remember, even if only Government money is involved at the present time, you will pay part of the cost eventually. Conservation of Government spending is always of benefit to you.

A Good Policy

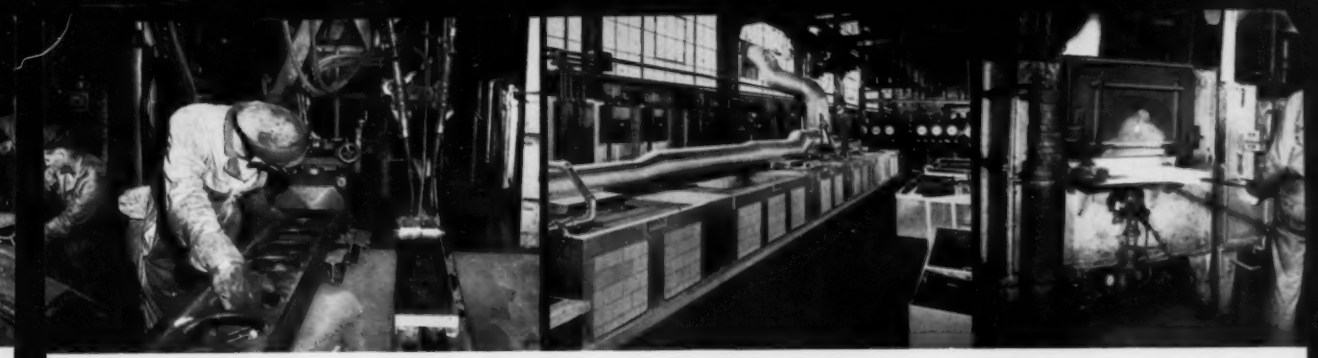
When faced with heat treating problems, or the need for heat treating services, contact the Metal Treating Institute or any MTI member listed on the facing page. All detailed inquiries receive prompt attention.

National Trade Association

COMMERCIAL HEAT TREATERS

METAL TREATING INSTITUTE

271 NORTH AVENUE NEW ROCHELLE NEW YORK



ercial Heat Treater Can Give You COMPLETE Service . .

ere's a Heat Treating Specialist Near Your Plant!

CALIFORNIA

California-Doran Heat Treating Co.
2850 E. Washington Blvd., Los Angeles 23
Cook Heat Treating Corp.
5934 Alcoa Ave., Los Angeles 11
Hollywood Heat Treating Co.
1046 No. Orange Drive, Los Angeles 38
Lindberg Steel Treating Co.
2910 S. Sunol Drive, Los Angeles 23
Dexter Metal Treating Co.
1026—77th Ave., Oakland 21
Industrial Steel Treating Co.
1549—32nd St., Oakland 8

COLORADO

Metal Treating & Research Co.
4110 Fox St., Denver 16

CONNECTICUT

Commercial Metal Treating, Inc.
89 Island Brook Ave., Bridgeport 6
Stanley P. Rockwell Co.
296 Homestead Ave., Hartford 5

ILLINOIS

Senecca Heat Treating Co.
70 S. Batavia Ave., Batavia
Accurate Steel Treating Co.
2226 W. Hubbard St., Chicago 12
Chicago Steel Treating Co.
333 North California, Chicago
Dura-Hard Steel Treating Co.
2333 West Deming Place, Chicago 47
Lindberg Steel Treating Co.
222 North Laflin St., Chicago 7
Pearson Industrial Steel Treating
5757 Ogden Ave., Chicago 50
Perfection Tool & Metal Heat Treating Co.
1740 West Hubbard St., Chicago 22
Fred A. Snow Co.
1942 West Kenzie St., Chicago 22
American Steel Treating Co.
P. O. Box A, Crystal Lake
Eklund Metal Treating, Inc.
721 Beacon St., Love Park
O. T. Muehlemeyer Heat Treating Co.
1531 Preston St., Rockford

INDIANA

Nerl Heat Treat Corp.
1824 So. Franklin St., South Bend 23

MARYLAND

Maryland Tool Company
111-13 Hollingsworth St., Baltimore 2

MASSACHUSETTS

New England Metallurgical Corp.
9 Alger St., South Boston 27
Porter Forge & Furnace, Inc.
74 Foley St., Somerville 43
Greenman Steel Treating Co.
284 Grove St., Worcester 5

MICHIGAN

Acme Steel Treating Co.
119 Lieb St., Detroit 7
Anderson Steel Treating Co.
1337 Maple St., Detroit 7
Bosworth Steel Treating Co.
18174 West Chicago Blvd., Detroit 28
Commercial Steel Treating Corp.
6100 Tireman Ave., Detroit 4
Commonwealth Industries, Inc.
5922 Commonwealth Ave., Detroit 8
Michigan Steel Processing Co.
3120 Denton, Detroit 11
Standard Steel Treating Co.
3468 Lovett Avenue, Detroit 10
Vincent Steel Process Co.
2424 Bellevue Ave., Detroit

MINNESOTA

Metallurgical Control Labs.
2226 East Lake St., Minneapolis 7

MISSOURI

Metallurgical, Inc.
1915 Tracy Ave., Kansas City 8
Lindberg Steel Treating Co.
650 East Taylor Ave., St. Louis 15
Paulo Products Co.
5711 West Park Ave., St. Louis 10

NEW JERSEY

Ace Heat Treating Co.
611 Grove St., Elizabeth
American Metal Treatment Co.
Highway 25 and LaFayette St., Elizabeth
Benedict-Miller, Inc.
Marin Ave. and Orient Way, Lyndhurst
Bennett Steel Treating Co.
246 Raymond Boulevard, Newark 5
L-R Heat Treating Co.
107 Vesey St., Newark

NEW YORK

Fred Heinzelman & Sons
138 Spring St., New York 12
Alfred Heller Heat Treating Co.
391 Pearl St., New York 7
Metro Heat Treat Corp.
466 Broome St., New York 13
Lindberg Steel Treating Co.
620 Buffalo Road, Rochester 11
Syracuse Heat Treating Corp.
1223 Burnet Ave., Syracuse 3

OHIO

Cincinnati Steel Treating Co.
Wooster Pike & Mariemont Ave.,
Cincinnati 27
Queen City Steel Treating Co.
2980 Spring Grove Ave., Cincinnati 25
Ferrotherm Co.
1861 E. 65th St., Cleveland 3
Lakeside Steel Improvement Co.
5418 Lakeside Ave., Cleveland 14
George H. Porter Steel Treating Co.
1265-71 East 55th St., Cleveland 14
Reliable Metallurgical Service, Inc.
3827 Lakeside Ave., Cleveland 14
Winton Heat Treating Co.
20003 West Lake Road, Cleveland 16
Dayton Forge & Heat Treating Co.
2323 East First St., Dayton 3
Ohio Heat Treating Co.
1100 East Third St., Dayton 2

PENNSYLVANIA

Robert Wooler
Limekiln Pike, Dresher
J. W. Rex Co.
834 West Third St., Lansdale
The Drever Company
220 West Cambria St., Philadelphia 33
Lorenz & Son
1351 N. Front St., Philadelphia 22
Metlab Company
1000 East Mermaid Lane, Philadelphia 18
Wiedemann Machine Co.
4272 Wissahickon Ave., Philadelphia 32
Ferrotherm Company
4911 Butler St., Pittsburgh
Pittsburgh Commercial Heat Treating Co.
49th St. and A.V.R.R., Pittsburgh 1

TEXAS

Cook Heat Treating Co., of Texas
6233 Navigation Boulevard, Houston 11

WISCONSIN

Wesley Heat Treating Co.
825 South 21st St., Manitowoc
Hushek Metal Processing Co.
1536 West Pierce St., Milwaukee
Metal Treating, Inc.
720 South 16th St., Milwaukee 4
Supreme Metal Treating Co.
4440 West Mitchell St., Milwaukee 14
Thurner Heat Treating Co.
809 West National Ave., Milwaukee 4
Wesley Steel Treating Co.
1301-1403 West Pierce St., Milwaukee
Harris Metals Treating Co.
1745 Taylor Ave., Racine

These names are **YOUR** *guide to the* **BEST** *in Heat Treating!*

New Board Chairman

Charles Allen, Jr., Chairman of the Board of the Colorado Fuel and Iron Corporation was named Chairman of the Board of John A. Roebling's Sons Corporation, a new Colorado Fuel and Iron subsidiary which has acquired the 112-year old firm of John A. Roebling's Sons Company, Trenton, New Jersey.

The Colorado Fuel and Iron Corporation, the nation's ninth largest steel producer, has completed the acquisition of the plants, inventories and business of John A. Roebling's Sons Company.

Accurate Automatic Control of Furnace Atmospheres

The Research Department of Lindberg Engineering Company has released data on the newest development, a device to automatically control and record the carbon potential of furnace atmosphere.

The Lindberg Carbotrol is a proportioning instrument which enables the heat treater to set his atmosphere or furnace in equilibrium with any steel.

It is said that the new instrument is now being subjected to extensive field application tests and should be ready for production in approximately six months.

For a technical report on the new Carbotrol, write to Lindberg Engineering Company, 2450 West Hubbard Street, Chicago 12, Ill.

Klem Announces "Rust-Sol #123"

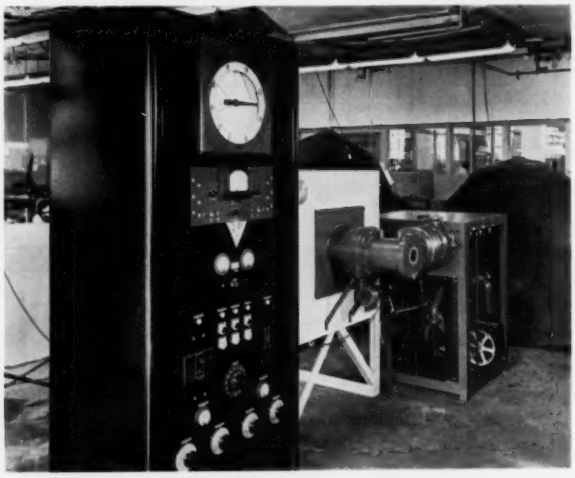
Klem Chemicals, Inc., 14401 Lanson, Dearborn, Michigan, announces a phosphoric acid cleaner in concentrate form for ferrous metals. Designated as "Rust-Sol # 123," this cleaner can be applied either by brush-on or immersion method and rinsed off with clear water.

"Rust-Sol #123" is said to dissolve all surface salts, rust, scale, etc. from production pieces, and to neutralize and activate the surface with a slight etch and iron phosphate coating which makes a satisfactory base for paint.

Because of its neutralizing action, this cleaner can also be used following alkali stripping or cleaning.

High Vacuum Heat Treating

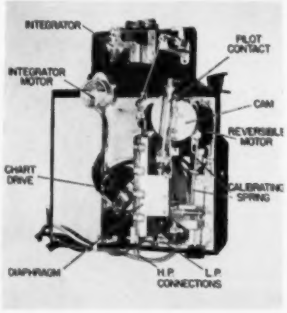
A high vacuum heat treating furnace produced by Consolidated Vacuum Corp., Pasadena, Cal., is being used for bright annealing such items as high nickel content alloy bellows sections, watch springs, and the like. This unit is supplied as a complete package with controls approximately 20 inches long, and the diameter of the quartz tube is 6 inches. The unit can also be supplied with a stainless steel muffle of the same diameter. The temperature range is up to 1100° C. The vacuum pumping unit will produce and main-



tain a pressure of 1×10^{-5} mm. Hg at the temperatures mentioned above.

A vacuum gauge having a range of from 2×10^{-9} mm. Hg to 1 micron is included in the control panel illustrated, which also contains the switches for the furnace recording thermocouples to measure the temperature inside the vacuum chamber, as well as the necessary switches for the electrical gear included in the vacuum pumping system. An air blower unit is also incorporated to permit a more rapid cooling down of the muffle.

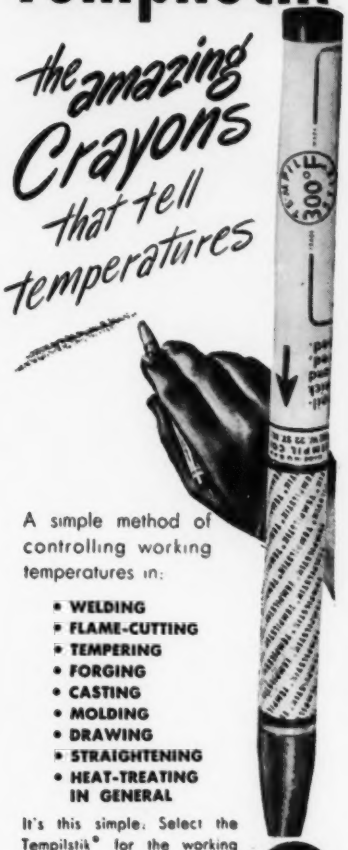
Diaflow Meter



The Hays Diaflow Meter, manufactured by the Hays Corporation, Michigan City, Ind., is a newly designed low differential flow meter for measuring air flow, gas flow or recording the ratio of air flow to gas flow. Adaptable for industrial furnaces, the Diaflow Meter is used as a guide in achieving product, process and cost control. Utilizing the pilot method of operation in which no load is placed on the measuring element the Diaflow Meter is designed to possess high accuracy with negligible friction. Since it uses a dry diaphragm type measuring element no water, oil, or mercury are required and leveling is eliminated.

Tempilstik®

the amazing Crayons that tell temperatures



A simple method of controlling working temperatures in:

- **WELDING**
- **FLAME-CUTTING**
- **TEMPERING**
- **FORGING**
- **CASTING**
- **MOLDING**
- **DRAWING**
- **STRAIGHTENING**
- **HEAT-TREATING IN GENERAL**

It's this simple: Select the Tempilstik® for the working temperature you want. Mark your workpiece with it. When the Tempilstik® mark melts, the specified temperature has been reached.

$2 each gives up to 2000 readings

Available in these temperatures (°F)

113	263	400	950	1500
125	275	450	1000	1550
138	288	500	1050	1600
150	300	550	1100	1650
163	313	600	1150	1700
175	325	650	1200	1750
188	338	700	1250	1800
200	350	750	1300	1850
213	363	800	1350	1900
225	375	850	1400	1950
250	388	900	1450	2000

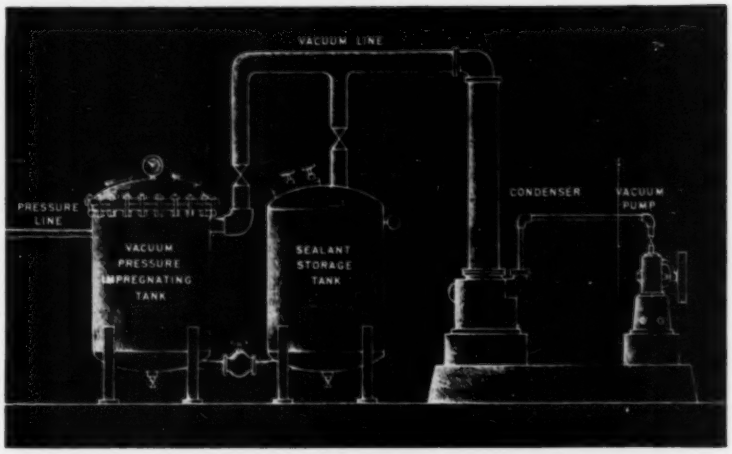
Also available in pellet or liquid form.

FREE —Tempil® "Basic Guide to Ferrous Metallurgy" — 16¼" by 21" plastic-laminated wall chart in color. Send for sample pellets, stating temperature of interest to you.

METAL & THERMIT CORPORATION

100 EAST 42nd STREET
NEW YORK 17, N. Y.

VACUUM-PRESSURE IMPREGNATION OF POROUS CASTINGS OFFERS PROFITABLE SIDELINE FOR METAL-TREATING PLANTS



Manufacturers are turning to impregnation of porous castings to improve casting quality.

Impregnation of porous castings assures pressure-tightness, extends service life and salvages rejects.

This is logical extra business for the commercial heat-treating plant when properly equipped for the work.

Complete Devine vacuum-pressure impregnating equipment can be installed in your plant at a surprisingly small capital outlay. It will be well worth your while to look into this new opportunity to expand your business. Write to us for more complete information.

J. P. DEVINE MFG. CO., Inc.

A. M. COX, President

49th St. and AVRR **Pittsburgh 1, Pa.**

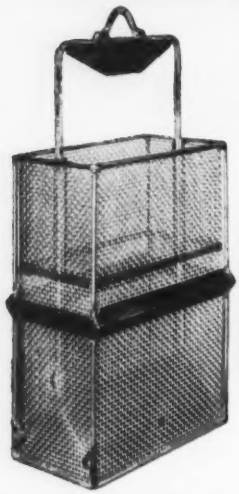
Devine

IMPREGNATORS

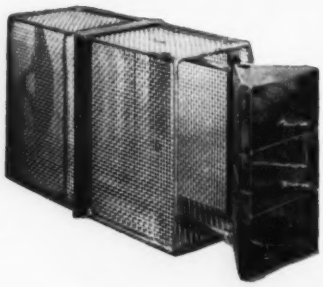
ROLOCK

HEAT AND CORROSION RESISTANT

FABRICATED ALLOYS



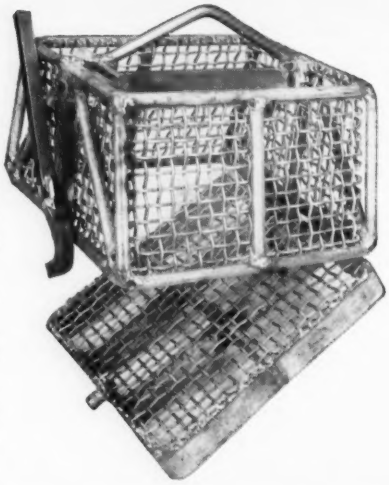
DROP-BOTTOM BASKETS
for fast release of load



Both baskets were fabricated-welded from alloys best suited for the exposures and, like other Rolock products, were job-engineered to suit the specific use. Among the thousands of designs created by Rolock engineers there are many that, with slight changes in shape or size, will fill the requirements of your heat treating plant or department.

To help you solve such problems we offer two excellent catalogs . . . No. B-8 Heat Treating Section and No. B-9 Corrosion Resistant Section. They picture and describe a great variety of designs in Baskets, Crates, Trays, Racks, Fixtures, Screens, Grids, Retorts, Muffles, Tanks, Sinks, Hooks, Chains, etc.

We have put more practical material into these catalogs than you will find in any other similar publications. COPIES ARE AVAILABLE ON REQUEST.



Drop-bottom salt pot basket (top) has lifting bars attached to solid sheet bottom. When assembly sets into holder frame over quench tank, bottom drops, releases load.

Above is a heavy duty basket with extra rugged hinged bottom, released instantly by disengaging lever from pin. Note single point suspension.

Offices in: PHILADELPHIA • CLEVELAND • DETROIT • HOUSTON • CHICAGO • ST. LOUIS • LOS ANGELES • MINNEAPOLIS • PITTSBURGH

ROLOCK INC. • 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

JOB-ENGINEERED for better work
Easier Operation, Lower Cost

SRLB3

Heat Treating Abstracts

Induction Hardening Boron Steel

Because of the recent uncertainty of obtaining alloy steels, Allison Div., General Motors Corp., made a few substitutions which resulted in a boron steel taking the place of alloy steels in huge locomotive gears. Originally the gears were made of SAE 4047 steel. Next came SAE 5046 and finally 14B45—the latter, one of the recently standardized boron steels. Slight variations in the heat treating procedures used for the previous steels proved suitable for the boron steel.

The 460-lb. gears are treated in a special 10,000 cycle per second induction heating unit. The workpiece revolves in the field of the induction coil at 5 rpm. The machined gears are heated to 1540°F. in 50 seconds. When heating has been achieved the part is rotated at a higher speed and then lowered into a quenching fixture where it is smothered in oil maintained at 120°F. This procedure provides a root hardness in the gears of 55 Rockwell C. Grinding to final size follows the quench. Induction hardening is used because distortion is virtually eliminated.

The boron steel heats to temperature in the same time as the SAE 5046 steel. Advantages of the boron steel are that it is easier to machine than the higher alloys and retains hardness better up to about 500°F. On the other side, the results with boron steels are somewhat erratic even though chemistry is similar between batches of steel.

(Abstracted from "Induction Hardening Boron Steel Gears," George Van Camp. *Materials & Methods*, November 1952.)

Carbidizing vs. Carburizing

In seeking a simple procedure for case hardening austenitic stainless steels, experiments were conducted to see whether carbidizing would be applicable. When tests proved the suitability of the process, definite procedures were developed. In carburizing, the case hardening effect results from the addition of carbon to the elements present in the steel. In carbidizing, carbides are produced by elements already present in the steel.

Ordinarily, the long time heating of stainless steel in a carburizing atmosphere, results in carbide precipitation which has a bad effect upon the steel. Carbidizing with a patented compound (Wilcarbo)

(Continued on page 31)

tool steel is our baby!

Tool steel is our baby. It has been for 52 years. It always will be. That's why tool steel users look with confidence to Crucible.

Crucible's research and development continues to match industry's need for new and improved tool steels. Our metallurgical staff — with a background of thousands of applications is freely available to you. Complete stocks of tool steels are maintained in our conveniently located Crucible Warehouses, for prompt delivery. Turn confidently to Crucible for all your tool steel requirements.

SEND TODAY for the unique Crucible Tool Steel Selector — a twist of the dial gives the tool steel for your application.

Rex® High Speed Steels
Peerless Hot Work Steels
Halcomb 218
Chro-Mow®
Sanderson Carbon Tool Steels
Ketos®
Airkool Die Steel
Airdi® 150
Nu-Die V Die Casting Steel
CSM 2 Mold Steel
La Belle® Silicon #2
Atha Pneu

SPECIFY YOUR TOOL STEELS BY THESE BRAND NAMES

Crucible Steel Company of America
Dept. MT, Chrysler Building, New York 17, N. Y.

Name_____

Company_____ Title_____

Address_____ City_____ State_____

9" diameter, 3-colors

CRUCIBLE first name in special purpose steels

52 years of Fine steelmaking

TOOL STEELS

IT PAYS TO CONCENTRATE!

If you sell materials, parts, finishes or materials processing equipment, it pays to concentrate your advertising in Materials & Methods. More than 20,000 materials men—paid subscribers—*concentrate* on M & M, which deals *exclusively* with the materials problems of product design and manufacture.

Materials & Methods

REINHOLD PUBLICATION

The Only Magazine of Materials Engineering

ABC • ABP

SOME CRACK cross-word puzzle addicts are unable to multiply ⅛ by ⅓, and that probably goes for certain adult experts on quiz programs.

* * *

THESE PARAKEETS are even cleverer than Burt MacBride of Reader's Digest thinks. Ruth Bradbury's Australian shell parakeet in Phoenix, Arizona is called Gabby and he's fifteen months old.

HEAT TREATING HINTS

Dimensional Changes in Tool Steel

A question frequently asked whenever and wherever the subject of dimensional change is discussed is: "When martempering, what effect does the length of time at the martempering temperature have upon the magnitude of dimensional changes?"

To answer this question for at least one grade of steel, we conducted a relatively simple experiment. Three test bars, ¾" round and 4" long made of a manganese, chromium, tungsten oil hardening tool steel (J.I.C. Type 01)* were heat treated as follows:

(1) All bars were preheated at 900°F. for one hour, then austenitized in a controlled atmosphere furnace for 30 minutes.

(2) One bar (A) was quenched in oil at 120°F. and allowed to reach this temperature after which it was cooled in air.

(3) One bar (B) was quenched into salt at 400°F., held ten minutes then air cooled.

(4) One bar (C) was quenched into salt at 400°F., held 8 hours then air cooled.

Dimensions were checked before and after hardening and again after tempering at 400°F. for two hours.

The results of these tests show that increasing the time at the martempering temperature tends to minimize dimensional change (growth) at least on the length dimension. No difference resulted on the diametral dimension. The growth on the oil quenched test piece was considerably less (on the length only) than on either salt quenched test piece. Note also that on tempering, the oil quenched test piece shrunk to its original dimension whereas on the salt quenched test pieces, the change on tempering was very slight. These results are in general agreement with those obtained in the production heat treatment of tools and dies of comparable sections (mass) made of similar steels.

It should be mentioned that on the basis of available TTT (transformation temperature time) curves for this grade of steel, eight hours at 400°F. actually represents an austempering treatment. This is based on the fact that at 400°F., transformation begins isothermally at approximately 15 minutes and ends at approximately 4 hours. Theoretically, then, the microstructure consists entirely of low temperature isothermal transformation products with no martensite at all. On the other hand, the test piece which was quenched in salt for ten minutes, consists entirely of martensite because when it was removed from the salt it was still completely austenitic (soft) which constituent then transformed to martensite on cooling in air. If we assume that martensite represents the most voluminous structure in hardened steel, then the variations in dimensional change must be due also to variations in thermal and transformation stresses rather than to differences in volume as represented by microstructures.

The results of these tests are tabulated below. All dimensions (changes) are related to the green (annealed) dimensions.

*J.I.C. is the abbreviation for Joint Industry Conferences which are designed to promote the standardization of the identification and classification of tool steels.

TEST NO. Treatment (quench)	A. Oil 120°F	B. 400°F salt 10 minutes	C. 400°F salt 8 hours
As quenched hardness, R.C.	63	60	58
Dimensional change after hardening, inches/inch			
Length	plus .0005"	plus .0011"	plus .000875"
Diameter	plus .0016"	plus .00093"	plus .00093"
Tempered hardness, R.C.	58.5	58	58
Dimensional change after tempering, inches/inch			
Length	None	plus .001"	plus .00075"
Diameter	plus .0016"	plus .00093"	plus .00093"

E. J. PAVESIC
Lindberg Engineering Co.
Chicago, Ill.

IT'LL ALWAYS WORK

Just because some guys ain't buyin'

Ain't no reason to start cryin'

Lots of others'll gladly buy

If you call and show 'em why!

COMPACT

ACCURATE

LIGHT WEIGHT

DEPENDABLE

wheelco

PORTABLE POTENTIOMETER

Designed for precise checking and calibrating of temperature measurement and control instruments, the Wheelco Portable Potentiometer is a versatile instrument.

- Entirely self-contained, it requires no external accessories. A special compartment accommodates dry cells for supplying current to the potentiometric circuit.
- Accurate to .025 millivolts, sturdily constructed for long laboratory or field service, convenient in size, weight and portability — the Wheelco Potentiometer is RIGHT for your requirements.

FOR A COMPLETE DISCUSSION OF FEATURES AND SPECIFICATIONS SEND FOR BULLETIN A502

FOR LABORATORY, PLANT AND FIELD SERVICE WORK

- ACCURATE TO .025 MILLIVOLTS
- COMPLETELY SELF-CONTAINED
- STURDY ALUMINUM FRAME

BARBER COLMAN

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BARBER-COLMAN COMPANY

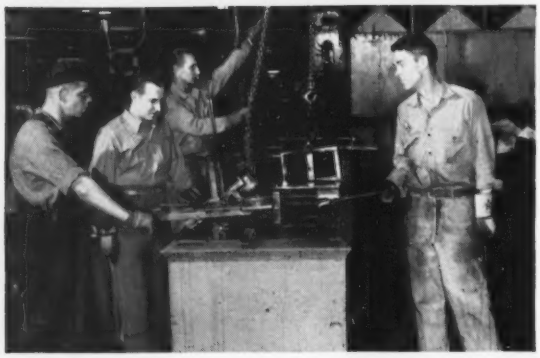
1225 ROCK STREET • ROCKFORD, ILLINOIS

NEW SUPER QUENCH OIL..

. . . GIVES YOU TRIPLE ACTION!

1 FASTER, DEEPER HARDENING

Mineral intensifiers give Park Triple A Oil faster quenching speed through the critical range, resulting in faster and deeper hardening.



2 LESS DISTORTION

Fast, uniform hardening in the critical range, plus a low cooling rate through the temperature zone of martensite formation, means less distortion from Park Triple A Oil.

3 BRIGHT QUENCHING

Special anti-oxidants used in Park Triple A Oil give it greater stability for longer life and bright quenching properties. This is important when work is quenched from carbo-nitriding furnaces.

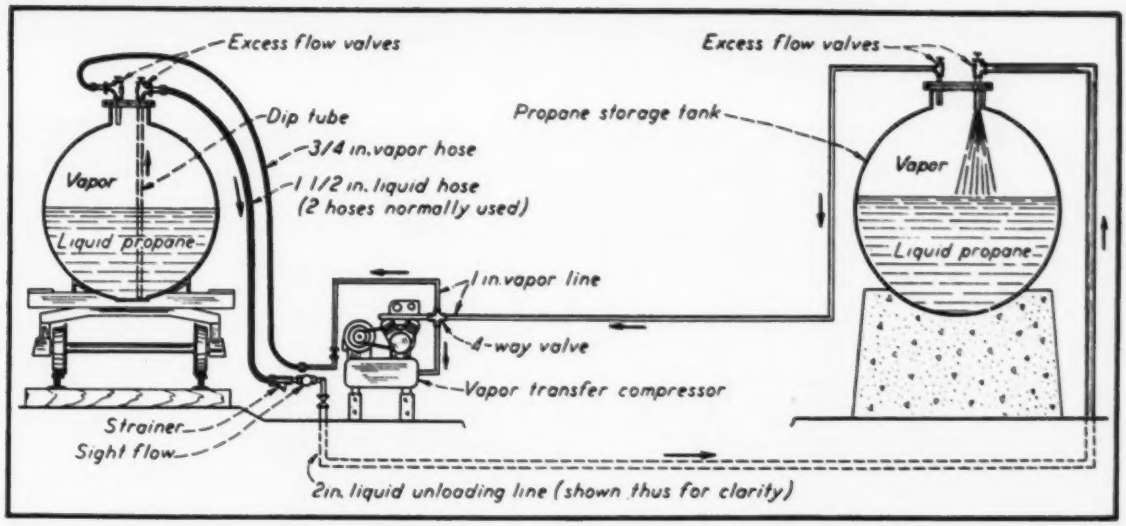
Unretouched photographs of precision parts quenched from a carbo-nitriding furnace in Park Triple A Quench Oil. From left to right are parts quenched the first day, 30 days later, 60 days later, and 90 days later. Bright and clean after over 3 months use with no indication of reduction of surface cleanliness.

For Hot Oil Quenching up to 450° F use Park Thermo Quench Oil. Send for Bulletin No. F-7.

For These Critical Times . . .

Now more than ever you will need Park Triple A Quench Oil . . . with steels of critical hardenability due to lean alloy content and parts manufactured under government contracts, you can't afford costly rejects due to rigid inspection. Get the most from your quench oil — get Park Triple A Quench Oil today and save on critical material and expensive rejects. Send for Bulletin No. F-8 today, for complete information.

Park
CHEMICAL COMPANY
8076 Military Ave., Detroit 4, Mich.



Recommended piping arrangement for transfer of liquid propane from tank car or motor truck to plant storage tank is shown here. Operation is safe and fast when a transfer compressor is utilized in the vapor line.

Natural gas, where it is available, is the accepted fuel in atmosphere generation and other applications of the heat treating industry. The availability of natural gas on an interruptible rate offers considerable economy in operation over such service on the higher rate schedules. The savings possible with the lower interruptible rate often will pay for a propane-air gas standby plant in two to four years. Thus, with such standby protection, it is possible for the heat treating firm to have all the advantages of the economical natural gas and still have adequate guarantee against supply interruption during the colder weather when domestic heating is given preference for available gas supplies.

The thousands of installations using propane-air gas as a standby fuel to natural gas attest to the satisfactory performance of this uniform gas supply. Propane-air gas can be used as a 100% replacement of natural gas and can be so mixed that it can be substituted for the natural gas without readjustment of the gas burners. It may also be mixed in with the natural gas in any ratio when the natural gas is only partially curtailed. With most equipment, even the most experienced operator cannot tell when the gas being used is the natural gas or the replacement propane-air gas.

With a standard propane tank 9 ft. in diameter x 67 ft. long it is possible to store (in liquid form) the equivalent of approximately 2,500,000 cubic feet of natural gas. With this concentrated gas supply it is possible to purchase the propane during the off-season when it is usually lower in cost and then hold it in reserve until needed. This investment is actually *insurance* against loss of production, but unlike ordinary insurance, it *prevents* the loss by advanced planning.

The satisfactory performance of a propane-air gas plant depends largely upon the proper design of the plant. The several general types of plants are satisfactory for certain applications, but each is not satisfactory for all applications. It is therefore important that the officials of a heat treating firm consider well the matter of the best design to suit *their particular needs*. The propane-air gas plant should be designed especially for the actual conditions at the given plant. When this is done, complete satisfaction will result from its use.

IN AFFAIRS of the heart one ugly word is remembered long after all the nice words are forgotten.

* * *

THE WORST MISTAKES are made while trying to cover up or gloss over smaller mistakes.

* * *

FRIENDS don't wish you any misfortune, but news of bad luck that befalls you is received by them with equanimity.

* * *

ONCE YOU GET UP momentum, keep working, because you can do twice as much in half the time when you're in the mood —or groove, as the old saying goes.

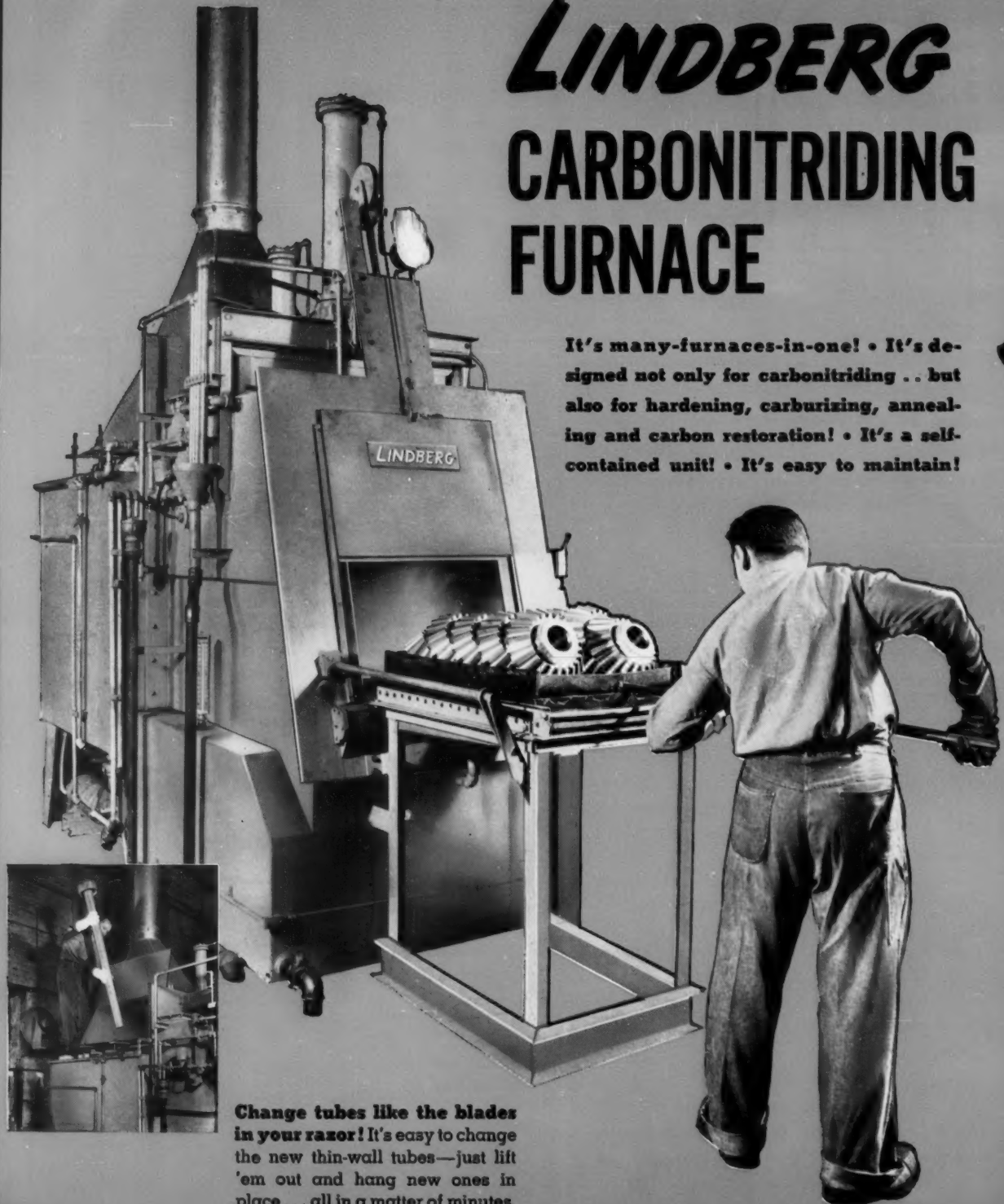
* * *

MARRIAGE resembles a pair of shears so joined that they cannot be separated; often moving in opposite directions, yet always punishing anyone who comes between them.—*Sydney Smith.*

Here's the new...

LINDBERG CARBONITRIDING FURNACE

It's many-furnaces-in-one! • It's designed not only for carbonitriding . . but also for hardening, carburizing, annealing and carbon restoration! • It's a self-contained unit! • It's easy to maintain!



Change tubes like the blades in your razor! It's easy to change the new thin-wall tubes—just lift 'em out and hang new ones in place . . . all in a matter of minutes.

The greatest advance in industrial furnace design and construction since Lindberg introduced the Cyclone forced convection tempering furnace back in 1935!

A 320 lb. load of CRS sleeves. Carbonitrided .010 to .015". 90 minutes in heating chamber. Temperature, 1600° F.

A 400 lb. load of CRS hex nuts. Carbonitrided .001 to .005". 60 minutes in heating chamber. Temperature, 1600° F.

Yes, you must see the new Lindberg Carbonitriding Furnace. It's many furnaces in one . . . it's easy to maintain . . . it's a self-contained unit.

Check these important construction features . . . features that will improve production quality and volume, and reduce production costs.

Many furnaces in one . . . Furnace atmosphere is provided by the Lindberg "Hyen" endothermic atmosphere generator that is easily adjustable to supply different atmospheres not only for carbonitriding, but also for carburizing, carbon restoration, bright hardening or annealing and normalizing. For annealing and normalizing the heated charge cools in the same chamber used for purging.

Easy to maintain . . . Instead of old style, heavy, unwieldly, horizontal radiant tubes . . . new gas-fired, lightweight tubes (only 29 pounds) are used. They're simple to change . . . turn off the gas . . . get on top the furnace . . . lift out the old tube . . . hang a new one in its place . . . and the thin, rolled metal tubes actually last longer!

Quench tank pit unnecessary . . . Your Lindberg Carbonitriding Furnace is self-contained, including a built-in pitless quench tank . . . thus you avoid costly excavation and piping. But more important, this built-in quench tank minimizes distortion . . . quenching takes place within the furnace structure, by means of a vertically operated elevator. Heated charges are never exposed to the air . . . as is the case when work is transferred from the heating chamber to a separate quench tank. Uniform case depth is assured because each charge automatically remains at heat the same length of time.

Purge chamber . . . A specially designed chamber, built immediately above the quench tank and in front of the heating chamber, receives work load for purging prior to heating.

For full details ask for Bulletin 241

A 120 lb. load of CRS screws. Carbonitrided .005 to .008". 45 minutes total time...temperature, 1580° F.

Lindberg Engineering Company

2466 W. Hubbard Street, Chicago, Illinois

LINDBERG FURNACES

Manufacturers' Literature . . .

The literature listed below contains information of interest to heat treating organizations. For your copy write direct to the manufacturer and be sure you mention seeing it reviewed in "Metal Treating."

NEW BOOK "THE TOOL STEEL TROUBLE-SHOOTER"

A 125-page book "The Tool Steel Trouble-Shooter" described as "a practical handbook to help you identify and correct the most frequent causes of tool and die failures" has been published by the Bethlehem Steel Company.

The book contains an analysis of 107 tool failures and is of particular interest to the heat treater because the section devoted to heat treating serves to emphasize the fact that many failures which are attributed to heat treating fall under two classifications:

1. Improper design or material
2. Unskilled heat treating procedure

The book is beautifully illustrated and will be a welcome addition to any heat treater's library.

A copy will be sent free upon request to the Bethlehem Steel Company, Bethlehem, Pennsylvania.

* * *

"WHAT'S NEW FOR THE LABORATORY"

The sixteenth edition of "What's New for the Laboratory" has been announced by the Scientific Glass Apparatus Co., Inc., Bloomfield, New Jersey.

Twenty-seven items are featured. Included are: A high-speed projection type balance which can also be used for analytical work; a device for trapping mercury blown from manometers; a surface temperature thermometer; two-stage vacuum pump; microscope with built-in illuminator; non-corrosive optical cover glass; sulfur determinator; glass distillation apparatus for small-scale operations; an automatic burette with solid Teflon plug and Teflon-coated joint; two accessories for the Beckman Model DU Spectrophotometer; a number of polyethylene items, and various other laboratory aids.

* * *

ALUMINUM MELTING FURNACES

A new bulletin on the complete line of Lindberg-Fisher Gas and Oil Fired Aluminum Melting Furnaces has been issued.

The bulletin contains photographs of the different types of aluminum melting furnaces, describes their uses and gives specifications.

Request your copy of Bulletin No. 310 "Lindberg-Fisher Aluminum Melting Furnaces" from Lindberg Engineering Company, 2444 West Hubbard Street, Chicago 12, Illinois.

* * *

COPPER-OXIDE RECTIFIER STACKS

A new 8-page, two-color booklet describing the basic characteristics and applications of copper-oxide rectifier stacks has been announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as GEA-5699A, the booklet is complete with charts, graphs and tables illustrating the characteristics, manufacture, circuit design and application of copper-oxide rectifiers.

* * *

MAGNETIC ALLOYS

An 8-page, "what is it," "where to use it" booklet, TD-52-100, on Magnetic Alloys has been prepared by the Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.

The various alloys that are covered in the booklet include Hipernik, Hipernik V, Conpernik, and Hiperco. The first three materials mentioned are iron-nickel alloys while the last is iron-cobalt alloy. These materials provide a wide range of magnetic properties needed for many special requirements.

Physical and magnetic property tables together with the availability of each alloy are included. These are accompanied by a discussion of individual alloy heat treatment techniques.

* * *

FABRICATED ALLOYS

Rolock Incorporated, Fairfield, Conn., manufacturer of equipment for heat treating and finishing of metal parts, has issued a new catalog, No. B-9 (Corrosion Resistant Section).

This section describes and pictures baskets, racks, crates, tanks, sinks and special equipment for degreasing, cleaning, dipping, galvanizing, pickling, quenching, and other processing operations.

Every type of basket, centrifugal, trunnion, drop-bottom, rotating (manual and motor-driven) is shown, including many unusual shapes and designs for specific duties.

Of special interest to manufacturers of steel shell cases are the new type of work-holder baskets, which serve through automatic cycles of many operations, after the cupping operation, and through the final draw. Included is Rolock's new articulated "Serpentine" grid, designed to retain its shape under severe exposures . . . as a tray or basket bottom.

NEW CONSTANT PRESSURE DIFFERENTIAL REGULATOR NEW INSTRUMENT AIR PRESSURE REGULATOR

Catalog 29 by Fischer & Porter Co., Hatboro, Pa., describes a new constant pressure differential regulator, and a new instrument air pressure regulator, The constant pressure differential regulator is a compact unit consisting of the air pressure regulator and a new phenolic body "Purgerator" Meter piped together on a bracket for wall mounting, or with a bezel which permits front or rear panel mounting. This unit is used to regulate purge flows of liquid or gas, for liquid level measurement or in dual arrangement for specific gravity measurement.

The new instrument air pressure regulator was developed especially for internal case mounting with the P-4 "Pneumatrol" pneumatic controller series. It is a compact design with a unique pressure balanced valve which maintains constant discharge pressure with a very low "droop."

* * *

QUENCHING OILS

Natural detergent qualities of Sun Oil Company s naphthenic-type quenching oils offer industrial users reduced maintenance and operating costs, according to a new booklet prepared by Sun and entitled "Sun Quenching Oils."

"Sun Quenching Oils," the illustrated booklet states, "can handle 95 per cent of all quenching jobs" in industrial heat treating. These oils are described as having a natural detergency that "not only prevents formation of sludge deposits but also helps to remove existing deposits."

Free copies of "Sun Quenching Oils" may be obtained by writing to Sun Oil Company, Philadelphia 3, Pa.

* * *

ELECTRIC FURNACE

The Hevi Duty Electric Company, Milwaukee, Wisconsin, announces a new bulletin IND-1147-EE which describes the Hevi Duty "Speed Treet" Electric Furnace. This furnace was designed to heat treat high speed steels where temperatures up to 2600°F. are required. Gas-tight construction permits the use of a controlled atmosphere.

Also illustrated is the Hevi Duty Tool Room Combination which consists of an atmosphere generator, pre-heat, high temperature, and tempering furnaces. Many industrial users have found this combination of utmost importance in heat treating the tools and dies demanded by their production lines.

* * *

TIME-CYCLE CONTROLLER

Publication of a twelve-page bulletin, No. C305, describing its line of Time-Cycle Controllers has just been announced by The Bristol Company, Waterbury, Conn.

Information is given on the application of these controllers in timing industrial process operations and heat treating.

The bulletin liberally illustrates the various models available and describes the principle of operation in detail.

* * *

REFERENCE TABLES FOR TOOL STEEL USERS

A. Milne & Co., nationwide distributors of solid and hollow tool steels, has published a booklet of reference tables for tool engineers, metallurgists and other executives.

The eight-page, file size booklet features a temperature conversion table of the Albert Saveur type which simplifies Fahrenheit to Centigrade and Centigrade to Fahrenheit conversions. Also included are a hardness conversion table, convenient shop formulas for obtaining weights of steel bars, a table for determining weights of steel bars of various shapes in pounds per foot, and decimal and millimeter equivalents of fractions of an inch.

A copy of this booklet may be obtained by request on company letterhead either to Milne's main office at 745 Washington Street, New York 14, N. Y., or to any of the Milne offices located in principal cities in the U. S. and Canada.

* * *

PLASTIC MOLD CLEANING

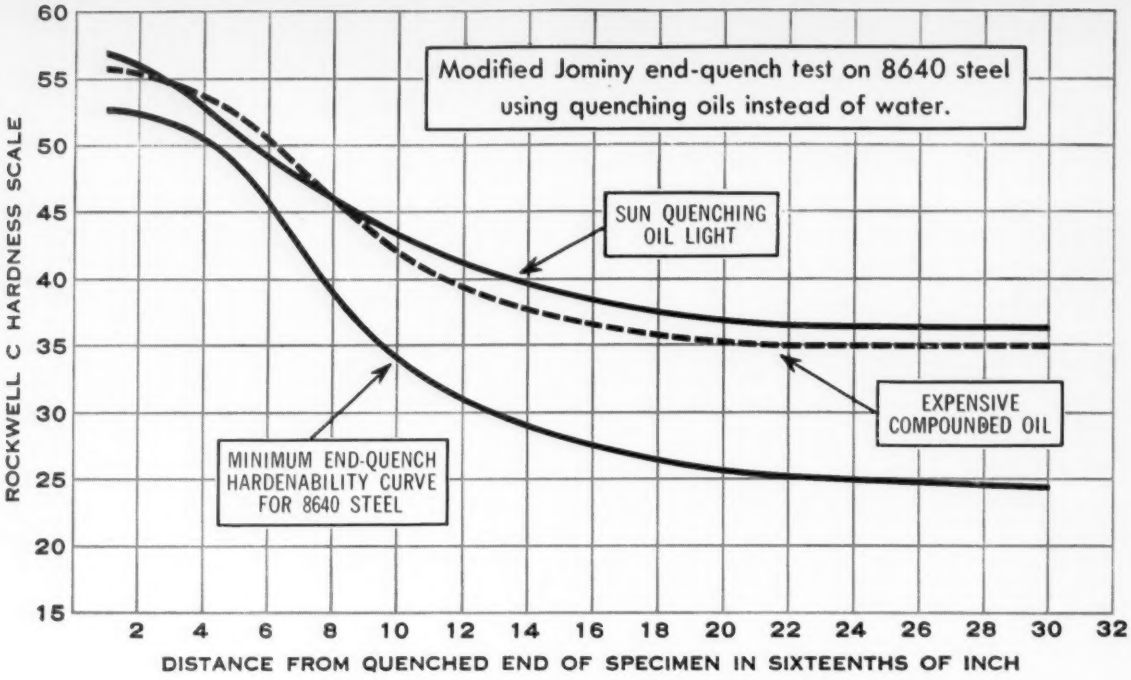
"Finish Plastic Molds In Minutes" is the title of a new 4-page bulletin No. 63, just published by American Wheelabrator & Equipment Corporation, 1175 South Byrkit Street, Mishawaka, Indiana, on the subject of wet blasting plastic molds.

This illustrated brochure shows how wet blasting is used both in the original manufacture of molds and in their reconditioning maintenance to bring about important savings of time and labor, and reduce manual polishing requirements. Wet blasting during manufacture of a mold blends all grinding lines, tool marks, and surface imperfections and removes heat treat scale. During reconditioning, it is done to remove the carbonaceous deposits which form and the plastic resins which adhere to the mold surfaces.

* * *

"WHICH SURFACE HARDENING PROCESS?"

The Metal Treating Institute, 271 North Avenue, New Rochelle, New York, has available for heat treaters a reprint of a 4-page article which will prove very useful to all heat treaters and heat treating departments. Entitled "Which Surface Hardening Process," the material describes in detail the characteristics, hardness ranges, advantages and disadvantages of the basic types of heat treatment.



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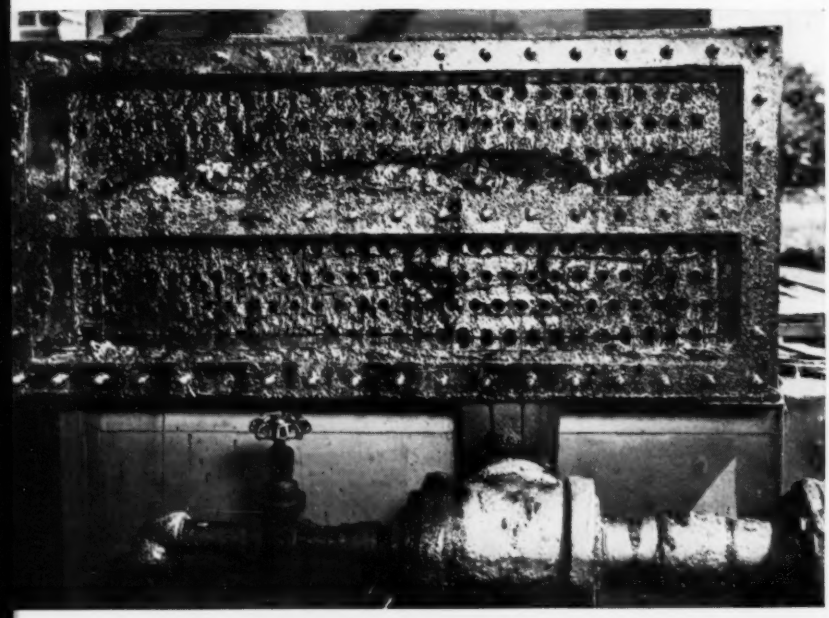
THIS PLANT QUENCHES ALL TYPES and sizes of automotive and aircraft forgings. Sun Quenching Oil Light serves all five of the 2400-3000 gallon systems. In the seven years the shop has been using this oil, no unit has been down except for normal mill scale removal.



AN OIL THAT FORMS SLUDGE CLOGS oil coolers, increases maintenance and operating costs. Sun Quenching Oils have a natural detergency which helps keep the systems clean and removes any deposits that may exist.

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increases the steel's wear resistance without accelerating corrosion around grain boundaries.

In case hardening stainless, the following procedure was developed for 303 stainless: parts are packed in the carbidizing compound in non-ferritic packing boxes and heated at 1900°F. for 2 hours and then box cooled. Depth and degree of hardness was proved independent of the cooling rate, but box cooling was simple.

Greatest wear resistance is provided to parts treated in tightly sealed boxes and the results seem to be more consistent.

(Case Hardening of Austenitic Stainless Steels by the Carbidizing Process," by Lloyd M. Allen and Dudley Woodard, *Steel Processing*, December 1952.)

Malcomizing

Another method of case hardening stainless steel is being more widely used now on a variety of parts. The process is patented and is known as "Malcomizing." The treatment produces an intense superhard surface through the action of nitrogen on the steel surface. Chromium in the stainless acts as the hardening element.

Malcomizing is used when the highest degree of wear resistance is needed. Dimensional change is minimized in the treatment because of the low temperatures involved. Other treatments are required prior to Malcomizing to provide a uniform microstructure and remove or relieve any severe stresses. In addition, all surfaces to be treated must be machined and sharp corners relieved. The process is not recommended for fine threads. Selective treatment is possible through plating processes.

Hardness achieved exceeds 64.7 Rockell C and averages 68 to 70 Rockwell C. Maximum hardness is attained at 0.001 to 0.002 inches below the surface, thus the surface is removed to reach the hardest surface. Penetration reaches 0.006 to 0.008 inches in austenitic stainless steels and in other types depth varies from 0.013 to 0.015 inches. The Malcomizing process has a slight effect upon the corrosion resistance of the steels treated and, therefore, is not recommended for the most highly corrosive conditions.

Malcomizing is used on stainless steels because the oxide surfaces which form on such steels resist the usual nitriding techniques.

(Abstracted from "Malcomizing—A Method for Case Hardening Stainless Steel," by E. J. Pavisec, *Chicago Metalworker*, August 1952.)

LETTERS TO THE EDITOR

Dear Editor:

I would like to thank you for the Metal Treating Magazine. I receive it regularly. It brings helpful and valuable informations and I appreciate it really very much.

May I ask you for the booklet on Standards of Apprenticeship for the Heat Treating Trade (Union and non-Union forms)?

We are about to enlarge our heat treating department. As we do not have in this country experienced workers in Heat Treating, we had to start an instruction course on it. Your Standards of Apprenticeship will be helpful for us in connection with the course.

I thank you and I wish you a happy New Year.

Tel-Aviv, Israel — *JULIUS WEILER*

Dear Editor:

We have been receiving your booklet "Metal Treating" for some time and it is very helpful to us in our work. I would like to ask you to also send a copy to our Mr. L. Ellis who is our heat treat foreman and who would find this booklet very interesting.

Thank you for your cooperation in this matter.

STANLEY W. OTTO
Superintendent
Huron Forge & Machine Company
Detroit 4, Michigan

Dear Editor:

Please add my name to your mailing list to receive "Metal Treating." I find this to be a very helpful magazine.

WALTER N. FRANK
Metallurgical Department
Detroit Diesel Engine Division
Wayne, Michigan

Dear Editor:

I had the pleasure of reading your September-October, 1952, copy of "Metal Treating" and found it helpful.

This was the first time I had a chance to read your publication, which was given to me at the recent Metals Show in Philadelphia.

If possible, I would like to be placed on your mailing list.

MILTON C. PARSONS
Metallurgical Laboratory
Burroughs Adding Machine Co.
Detroit 32, Michigan

Dear Editor:

Please send a reprint of your article "Impregnation Seals Porous Castings" as written up in the September-October issue of *Metal Treating*.

Can you put me on your mailing list for my personal copy of *Metal Treating*?

WILLIAM HEFFRON
Chief Tool Engineer
Bulova Watch Company
New York

Dear Editor:

After receiving only two copies of "Metal Treating" I am sure they would be of great help to our foreman. I would appreciate it if you could send this valuable publication to the following men:

Mr. E. Cardillo at 242 Parkway, Rochester, New York.
Mr. R. Schwartz at 120 California Dr., Rochester, New York.
Mr. W. Yahn at 141 Wilbur Avenue, Greece, New York.

P. J. MALLOY
Plant Superintendent
Lindberg Steel Treating Company
Rochester 11, New York

Dear Editor:

My attention has been drawn to the outstanding coverage of the heat treating field given by your publication. The November-December issue is the first I have had passed along to me and I would like to get it first hand. Please place my name on your mailing list for future issues.

C. R. CASE
Wyncote, Pennsylvania — *Metallurgist*

Dear Editor:

I have had the opportunity of reading your September-October issue of "Metal Treating" and it was very informative.

I would appreciate it very much if you could add my name to your mailing list.

F. L. SCHAUERMANN
Industrial Heating Engr. Dept.
General Electric Company
Schenectady 5, New York

Dear Editor:

During my work as service metallurgist I have had occasion to see your publication and in that found answer to many problems encountered in the heat treating plant.

I would appreciate receiving your publication regularly and ask you to let me know how that can be arranged.

E. B. ANDERSEN
Skaneateles, N. Y. — *Service Metallurgist*

Dear Editor:

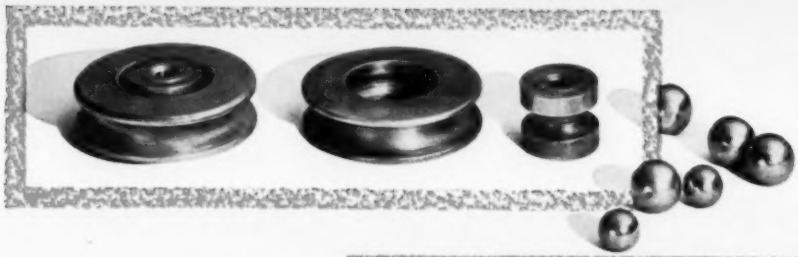
Although our office receives a copy of your magazine "Metal Treating," I would greatly appreciate being put on your mailing list for my own personal copy.

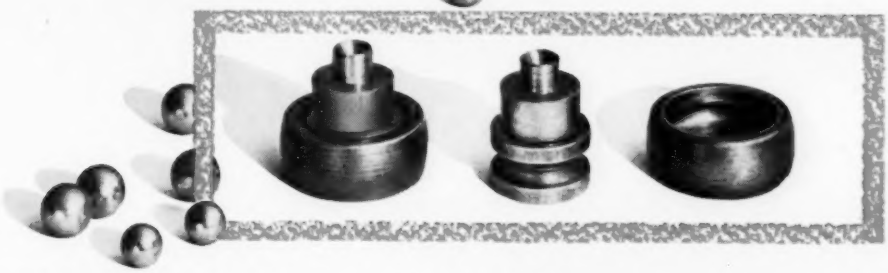
I have found your Feature Articles practical and informative.

Q. D. MEHRKAM
Metallurgist
Ajax Electric Company, Inc.
Philadelphia 23, Pa.

INDEX TO ADVERTISERS

	Page
Ajax Electric Company, Inc.	Inside Front Cover
American Brake Shoe Company	11
Houghton & Co., E. F.	13
Metal Treating Institute	16, 17
Devine Mfg. Co., Inc., J. P.	19
Metal & Thermit Corporation	19
Rolock, Inc.	20
Crucible Steel Company of America	21
Materials & Methods	22
General Manufacturing Co.	22
Wheelco Instruments Division	23
Park Chemical Company	24
Lindberg Engineering Company	26, 27
Sun Oil Company	30, 31
American Cyanamid Company	Inside Back Cover
Pressed Steel Company	Outside Back Cover





For uniform case depth, better wear resistance and brighter surfaces, PREFERRED BEARING, INC. liquid carburizes its bearing races in AEROCARB® E&W salt baths.

Preferred Bearing of Bristol, Conn., mass-produces ball bearings of various types for use as rollers in such products as industrial conveyors, overhead garage doors, sliding doors, kitchen ranges and cabinets, refrigerators, office furniture, etc.

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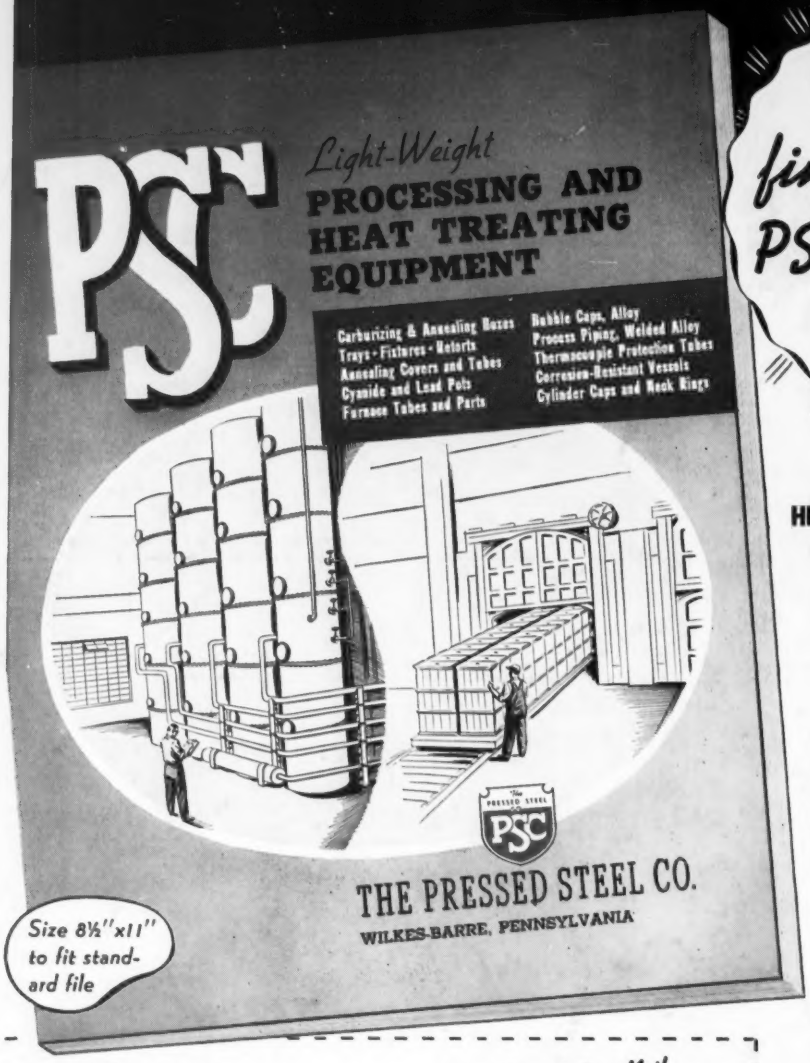

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CLASSIFICATIONS OF PSC HEAT AND CORROSION-RESISTANT INDUSTRIAL EQUIPMENT

Baskets, annealing & carburizing
Baskets, cyanide dipping
Baskets, pickling
Bends, alloy pipe & tubing (welding)
Boxes, annealing & carburizing
Caps, bubble (fractionating tower & still)
Caps, cylinder (compressed gas)
Covers, annealing (Bell furnace)
Covers, annealing (elevator furnace)
Fixtures, carburizing
Flights, conveyor (syn. rubber plant)
Headers, air pre-heating
Manifolds, gas exhaust
Muffles, carburizing
Piping, process (alloy only)
Pots, carburizing & annealing
Pots: lead, cyanide & salt
Racks, annealing & carburizing
Racks, sheet pickling
Retorts, carburizing
Rings, neck (compressed gas cylinder)
Tanks, copper annealing
Tanks, pickling
Trays, annealing & brazing
Tubes, annealing
Tubes, furnace vent
Tubes, radiant furnace
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